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An East River tunnel line, from Point View, on Long Island, to Ferry Point, on the New York side, is being surveyed by engineers of the Portchester & College Point R. R. Co. The width of river is given as "about two-thirds of a mile," the greatest depth of water is 72 ft. and distance to rock is 120 ft. The purpose of the tunnel would be to facilitate travel and traffic between Long Island, New York State and New England.

The bridging or arching of the Lackawanna River, at Scranton, Pa., is talked of. The estimated cost is $3,250,000, and it is proposed to combine with it a magnificent boulevard or avenue.

The proposed raising of the Harlem River bridge of the New Central R. R., 24 ft. above high tide, in accordance with the government plans for improving the Harlem River, is causing discussion at Albany. President Chauncey M. Depew is advocating it against the opposition of property holders who fear damage by the necessary raising of the tracks of the N. Y. Central south of the river. The improvement would cost the railway company $3,000,000. Four street bridges at 126, 127, 128 and 129th Sts., now crossing the track would have to be removed and replaced by footways passing beneath. But 130, 131, 132 and 133d Sts., and the River Ave., not yet built, would pass underneath the new structure.

The Chicago Elevated Terminal Ry. Co., whose project was described in our issues of Jan. 2 and 16, has had plans prepared for its terminal station at State and Twelfth Sts. The building will be ten stories high and will have a frontage of 350 ft. on State St. and 280 ft. on Twelfth St. South of this will be a trainshed 1,000 ft. long. On the corner will a high clock tower 60 ft. square. The main waiting room will be 174 × 350 ft., and the waiting room for suburban service 50 × 160 ft. The carriage court will be 150 × 50 ft. There will be the usual accommodations for dining rooms, toilet rooms, etc., and the first floor will be let out for stores, while the upper floors will be for offices. The cost of the building is estimated at $3,500,000.

Siemens steel is to be manufactured in India, according to "Indian Engineering," which states that the Government of India has taken up the question of steel production with the object of developing the mineral resources and increasing the local industries of the country, and has appointed Mr. Matthew Wright, Siemens furnace builder, of England, to go out and erect the first Siemens furnaces in India.

The vacuum brake has been adopted by the North London Ry. and will replace the old Clark & Webb chain brake. This step has been ordered by the Board of Trade and will involve an expenditure of $125,000. The company conservatively prefers the old brake, considering it better suited to its traffic. It is said that the chain brake has made 7,000 stoppages per day for seven years without any accident. In our issue of May 16, 1891, we referred to this brake and the frequency with which it slides the wheels, grinding the tires and rails.

Steam car heating is being introduced by the Midland Ry., of England, the steam being taken from the boiler of the locomotive and circulated through pipes round each compartment. The company is also introducing third-class (or really second-class, the company having only first and third-class cars) dining cars and sleeping cars.

An intercontinental railway for South Australia has been reported on by Mr. Price Williams, M. Inst. C. E., for an English syndicate, and the project has been submitted to the colonial government. It is said that the line presents no engineering difficulties, and that it would shorten the time between London and Adelaide by about eight days.

A two cylinder compound consolidated locomotive, designed by Mr. F. W. Dean, M. Am. Soc. M. E., of Boston, Mass., has been built by the Lehigh Valley R. R. The receiver is a horse-shoe pipe placed in the smokebox, and its volume is 2¾ times that of the high pressure cylinder. The leading diamensions are as follows:

Cylinders, h. p.	20 × 24 ins.
Cylinders, l. p.	30 × 24 ins.
Diameter of driving wheels	4 ft. 2 ins.
Diameter of boiler	4 ft. 10 ins.
Form of boiler	Belpaire.
Size of firebox	6 ft. by 11 ft. 6 ins.
Boiler pressure	175 lbs.
Tubes, number, 222; length	11 ft. 2⅝ ins.
Grate area	69 sq. ft.
Heating surface	1,638 sq. ft.
Driving wheel base	14 ft. 9 ins.
Total " "	22 ft. 10 ins.
Weight on driving wheels	169,088 lbs.
Weight on truck	16,464 lbs.
Weight total	125,552 lbs.

The worst railway accident of the week was a rear collision at Milwaukee, Wis., on the Chicago, Milwaukee & St. Paul R. R. causing seven deaths and as many more injuries. The shop workmen's train had been switched off the main track to let a passenger train pass, but the switchman with "criminal negligence" neglected to throw the switch back, and "a moment after," according to the official account, the passenger train took the switch and caused the collision. The absurdity of expecting that trainmen and switchmen will be exempt from the failing, common to all mankind, of occasional fits of absent-mindedness and forgetfulness at critical moments, and the necessity of using mechanism which cannot forget in crowded yards, is again illustrated.

The boiler of a locomotive on the Pennsylvania R. R., near Nicetown, Pa., exploded Feb. 16, killing 1 man and severely injuring 3 others.

A cable railway has recently been opened in Genoa Italy. It is 1,200 ft. long, with a difference in end elevation of 184 ft. It is operated on a single track, with a passing point at the center, by water-ballast or counterbalance on the down grade. A similar road has been in operation for some years at Lucerne.

The artesian and underflow investigations begun under the direction of the U. S. Department of Agriculture April 4, 1890, were completed Feb. 1. The preliminary reports on these subjects have already been noticed in Engineering News. The final report will soon be published, it is stated. Mr. Edwin S. Nettleton was Chief Engineer, Mr. Robert Hay, Geologist, and Mr. R. J. Hinton, Special Agent of the investigations. Mr. Hinton has just finished a Report on Irrigation in the United States in 1891, which, it is expected, will soon be published. In this connection it may be added that 15,000 additional copies of the Report of the Senate Irrigation Committee are, it is stated, now ready for distribution. This committee made an extended tour of investigation in 1889-90, and took a vast amount of testimony regarding irrigation.

Work on the Danube, at the Iron Gates, is progressing, but it is found to be more difficult than was anticipated. About 4,000 men are employed, and about 600,000 cu. m. of stone have been deposited in the dam to be formed across the river. It is expected, however, that the work will be completed in 1895, and at about the original estimate of $4,000,000.

Furnace slag to the amount of about 10,000,000 tons annually is produced in Great Britain, says Mr. W. Hawdon, in a late paper read before the Institution of Mechanical Engineers, in England. In the Cleveland District, where about 3,750,000 tons of slag are produced per year, it is either deposited on land costing from $2,000 to $5,000 per acre, or it is taken to sea in bopper barges. Mr. Hawdon treats at length of the various methods of dealing with molten slag, and getting it into shape for handling.

A territorial engineer of irrigation and forestry is proposed for Utah. The proposed act providing for the territorial engineer also provides for recording claims to water rights. The bill has been prepared under the direction of the American Association of Irrigation Engineers and the Polytechnic Society of Utah. Mr. C. L. Stevenson, Salt Lake City, is Secretary of the former body. Colorado, Wyoming and South Dakota, and possibly some other western states, have state engineers whose time is largely devoted to irrigation interests. It is only a question of time before each of the neighboring states have such an officer, and if wise each of these states will not let it be a long time.

Gen. Berdan's design for a new ironclad destroyer is before the House Committee on Naval Affairs at Washington. He proposes a vessel 260 ft. long, 40 ft. beam and 16 ft. draft, giving a displacement of 2,400 tons, with 20 knots speed. The special feature of the design is a heavy submarine gun in the bow which is to discharge an enormous shell loaded with 450 lbs. charge of gunpowder or other explosive. A hydraulic buffer is also arranged in the bow to stop the boat at a distance of 8 ft. from the enemy's ship. At this distance the buffer automatically discharges the gun.

The Brown segmental-tube wire-wound gun was tested, in an experimental section at Birdsboro, Pa., on Feb. 27. The tube was about 2 ft. long, 16 ins. in diameter and 5 ins. bore. It was made of accurately adjusted segments of steel, with an inner lining tube, and externally wound with steel wire applied under great tension. This cylinder was incased in a cast-steel jacket and closed at the ends by plugs with a ¾-in. vent and pressure gage on lower end. The explosion of 2¼ lbs. of powder showed a pressure of 35,200 lbs. per sq. in.; 2¾ lbs. gave 42,337 lbs. pressure and 3¼ lbs. showed 52,850 lbs. pressure. The test was considered successful.

A bill to abolish the New Croton Aqueduct Commission and turn over all uncompleted work to the Commissioner of Public Works of New York, is now before the New York Legislature, and is on its way to final passage. As the Cornell dam, one of the most important structures of the kind ever proposed, is among the unfinished work, engineers will regret any change in the present engineering control; and the citizens of New York may also have reason to deplore the execution of this work under purely political control, with its too common adjunct of bad work.

The Niagara Falls power tunnel is now being lined with brick; the coffer dam at the mouth of the canal is nearly completed, and the wheel-pit is sunk 30 ft. deep. This pit will be 140 ft. long, 18 ft. wide and 170 ft. deep when completed.

Our attention has been called to a misstatement regarding the water-works at Fort Smith, Ark., which by the transposition of a foot note appeared under Fort Smith instead of under Pine Bluff in the "Manual of American Water-Works" for 1890-91. The note in question stated that a receiver for the works would be applied for on the ground of alleged unsatisfactory management. We are assured by Woodbury & Moulton, of Springfield, Mass., and Portland, Me., who sold the bonds of the Fort Smith Water Co. and now hold some of the stock, that the works are being well managed and are giving satisfaction to the city.

Car stoves are prohibited on railways in the State of Ohio by a bill which has just passed the legislature of that state. Steam, hot water or hot air is to be used for car heating on all roads over 40 miles in length. Cooking stoves in dining cars must be of a pattern approved by the Railroad Commissioners. A penalty of $1,000, and $100 per day during continuance of use, is to be exacted for violation of this law.

A novel signaling apparatus is to be used in connection with the city water-works of Covington, Ky., to give warning of leaks in the supply main or any accident along the line needing immediate attention. The water supply for Covington is pumped from the Ohio River to reservoirs from which it passes by gravity through some eight miles of pipe to the city. As there is but a single pipe line, it is especially necessary to keep close watch of and repair leaks as soon as possible. It is proposed to parallel the pipe line with a telegraph wire strung on poles. Connected with the wire will be signal boxes located in farm houses and each having numbers. A card of instructions will be placed beside each box, with, for instance, the following code of signals: One ring, a land slide; two rings, a small leak; three rings, large leak; more than three rings, a serious break requiring immediate attention. The alarms will be sounded both in the city office of the works and at the pumping station, the number of the signal station being indicated as well as the character of the trouble. In case of a serious break the men at the pumping station will at once proceed to the reservoir and shut off the supply from the main, after which, of course, men would proceed to the break to make repairs. We are indebted to Mr. W. H. Glore, Superintendent of the Covington water-works, for the above information. Mr. Glore states that it is proposed to put in the signals as soon as the weather is suitable.

The Chicago & South Side Elevated Ry. is to be extended about 4¼ miles, and the contract has been awarded to the Keystone Bridge Works, of Pittsburg, for the sum of about $1,000,000. This road was described and illustrated in our issue of Jan. 16.

WORLD'S COLUMBIAN EXPOSITION.

Strata Underlying the Site.

When the site for the exposition was finally and definitely located at Jackson Park, it became necessary to make some investigations to ascertain the character of the ground, in order to decide as to the character of foundations required. Borings were therefore made in March, 1891, and we give herewith a plan showing the location of the bore holes and the character of the materials, as developed by these borings. We are indebted to Mr. E. C. Shankland, Engineer of Construction, for plans from which our cuts are prepared. The borings showed generally a top stratum of varying thickness of black soil over sand, or of sand alone, with in either case a lower stratum of quicksand 8 to 12 ft. thick, followed by 8 to 24 ft. of blue clay, below which is hard-pan in many cases. The nature and arrangement of the strata are clearly explained by the accompanying sections. In this connection we give the following abstract of a paper on "Foundations and Floors for the Buildings of the World's Columbian Exposition," by Mr. A. Gottlieb, M. Am. Soc. C. E., which was read before the Western Society of Engineers, at Chicago, in November, 1891. Mr. Gottlieb was formerly Chief Engineer of the Construction Department.

Foundations and Floors.

As Chief Engineer of the World's Columbian Exposition it was one of my duties to design and devise the foundations for buildings and determine the strength and mode of construction of floors for the various buildings. The exposition will be at Jackson Park, one of the public parks of the city, the use of which was granted under the express condition that all buildings erected there must be removed after the exposition closes and the park restored to its original condition. This means that the buildings will be in actual use for six months only, and then removed, being temporary structures in the strictest sense of the word. This fact naturally must be considered in the plans devised, as after six months use the bulk of the material must go to waste. The vast area to be covered by buildings (over 100 acres) required more care with reference to economy than is necessary in ordinary sized buildings, as any needless expense multiplies itself so enormously in those extraordinarily large surfaces.

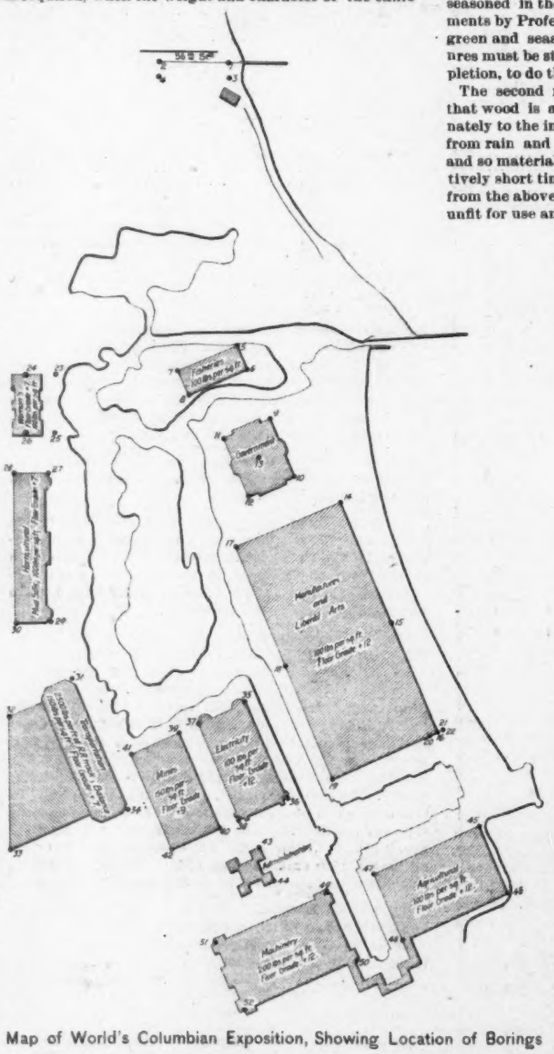
The natural formation at Jackson Park before the grading was done, was mostly low ground from + 0.5 to + 11 ft. above city datum; the average for about 300 acres was + 3.5 ft. The southern and the eastern parts were the lowest, the western part being the highest ground. City datum is the low water line of 1847, and the stage of the water in the lake for the last year was about one foot above datum. The highest stage ever observed for the last 50 years was 4 ft. above datum, except occasional tidal waves. By excavations from the high ground, and dredging of lagoons, material has been obtained to fill up the low grounds, so that the grade under buildings is at least 5 ft. above datum, and the ground outside of buildings 6 ft. above datum, with the exception of the terraces around the buildings, and the lake shore drive, which are from 10 ft. to 12 ft. above datum. The material of the fill is sand throughout. Borings in various parts of the grounds show the formation to be very uniform, as follows: About 5 to 8 ft. sand; 4 to 10 ft. quicksand; 6 to 10 ft. soft clay: 6 to 10 ft. clay, and then hardpan. The average depth below surface of the hardpan is from 26 to 36 ft. An exception to this is to be found in the higher locations, where the top layer of sand has a greater depth, and in the northwest corner of the Agricultural Building and the southern half of the Manufactures and Liberal Arts Building, where deep mudholes prevail, hardpan 30 to 45 ft. below surface.

I had first intended to have pile foundations under all buildings and piles driven for the floor supports. Before this was adopted, however, test piles were driven in different locations, partly to hardpan and partly to a lesser depth, and heavily loaded with sand. At the same time platforms of 3-in. planks were constructed, placed in different locations, on top of the sand, and loaded uniformly with pig iron, about 2¼ tons per sq. ft. These platforms were loaded gradually and the settling carefully noted under each load. The loads remained for several days and were then transferred to other platforms. It was found that under the maximum loading the settling was very small, about ⅜ in., and very uniform, and that after this settling had once taken place the increase of load up to 2¼ tons per sq. ft. caused no perceptible increase in settlement.

Platforms loaded on top of sand filling over the mud holes above referred to sank from 1 to 3 ft. under a load of 1½ tons per sq. ft., and kept sinking the longer the load remained on. It was thereupon determined to use pile foundations in these locations, and everywhere else where the formation was favorable platform foundations so proportioned that under a maximum load from buildings or from floor loads the pressure upon the ground would not exceed 1¼ tons per sq. ft. These platform foundations consist of 3-in. pine or hemlock planks, with blocking on top, to distribute the pressure from loads uniformly over all the planks, and to furnish support for the posts which carry the caps supporting the floor joists and posts of the buildings. The blocking was to be well spiked to platform planks and posts and caps and sills drift-bolted. The general floor loads for the various buildings and the grade of floors above datum were adopted as follows:

Buildings.	lbs. per sq. ft.	Floor grade above datum
Agricultural	100	12 ft.
Electricity	100	12 ft.
Fisheries	100	——
Horticultural	100	7 ft.
Manufactures and Lib. Arts	100	12 ft.
Woman's	100	7 ft.
Mines and Mining	150	9 ft.
Transportation	150	7 ft.
(and 2,500 lbs. per foot of railway track)	——	——
Machinery	200	12 ft.
Machinery Annex	200	——
Galleries	80	——

These are general floor loads only, intended for the aisles in the building, and for the lighter exhibits of each branch. Where heavy exhibits, machinery or tracks were to be loaded, the supports and floors to be reinforced as required, when the weight and character of the exhibits, and their exact location in the buildings were known.



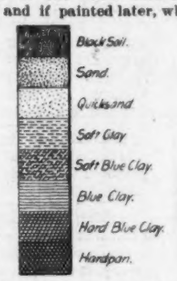
Map of World's Columbian Exposition, Showing Location of Borings

In proportioning the sizes of foundations and floors, to resist the maximum strains from above loads, I recommended the following unit strains: For bearing of vertical posts upon underlying blocking (head or end of fiber upon transverse fiber) 600 lbs. per sq. in.; tension in extreme fiber in caps and joists, 1,500 lbs. per sq. in.

Having for the last 25 years been engaged in the building of bridges, trestles, roofs and other structures of steel and iron, as well as of timber; and having seen the time when wooden bridges were used almost exclusively on the railways of this country, I may claim to know some thing of the material used, from my own observations. Railway bridges and trestles are subjected to the severest strains possible, more so than any other kind of construction. The maximum load for which they are proportioned, is sure to pass over them many times each day, sometimes many times each hour; the speed with which these loads pass over the structures is so great that the effect is vastly greater than it would be from a static load. Prof. Weyrauch has demonstrated by experiments that a rapidly applied load, quickly removed, has double the effect of a static load. Consider in connection with the load and speed, the unavoidable imperfections in the track and rolling stock, and it will be conceded that the utmost care in the selection of material, and in the framing and building up of the same must be exercised, and the largest practicable factor of safety used in proportioning the members of such structures; particularly such as receive a direct shock from the passing loads, as the lower chords of bridges, when supporting floor beams and track stringers, and the floor beams and stringers themselves. If the parts mentioned are of wood, as in Howe truss bridges and trestle work, two more factors require due consideration. While iron and steel members are strongest when new, the reverse is true of timber as generally used in large structures. The timber is more or less green or unseasoned, and consequently not as strong in the first period of the actual use, as it is a year or two after it has been seasoned in the open air. (I will show later from experiments by Professor Lanza, what the relative strengths of green and seasoned timbers are.) And yet these structures must be strong enough the first day after their completion, to do their duty.

The second most important point to be considered is that wood is a perishable material; its exposure alternately to the influence of the sun's rays and to moisture, from rain and snow, causes the same to crack and rot, and so materially weakens its strength until in a comparatively short time, from seven to ten years, if unprotected from the above mentioned agencies, it becomes entirely unfit for use and must be replaced with new parts.

While it is easy to protect metal parts of structures against destruction from corrosion by properly painting the same, this remedy will not apply to timber. New timber, if painted, will be destroyed quickly by rot, as the coat of paint prevents the evaporation of the moisture contained in the wood fibre from its growth; and if painted later, when the timber has been exposed, rot has usually already set in, particularly in joints, between keys and sticks. There is but one way to preserve timber, and that is by seasoning the same either in the air or by steaming, and preventing the moisture so eliminated from entering again. This can be obtained either by covering the structures, so as to exclude the sun and moisture, or by treating the wood by some preserving process. The principle involved in all wood preserving processes, is first the seasoning of the timber by steaming, thereby removing the moisture from the crevices, and then filling the crevices by some substance which will prevent atmospheric moisture from re-entering.



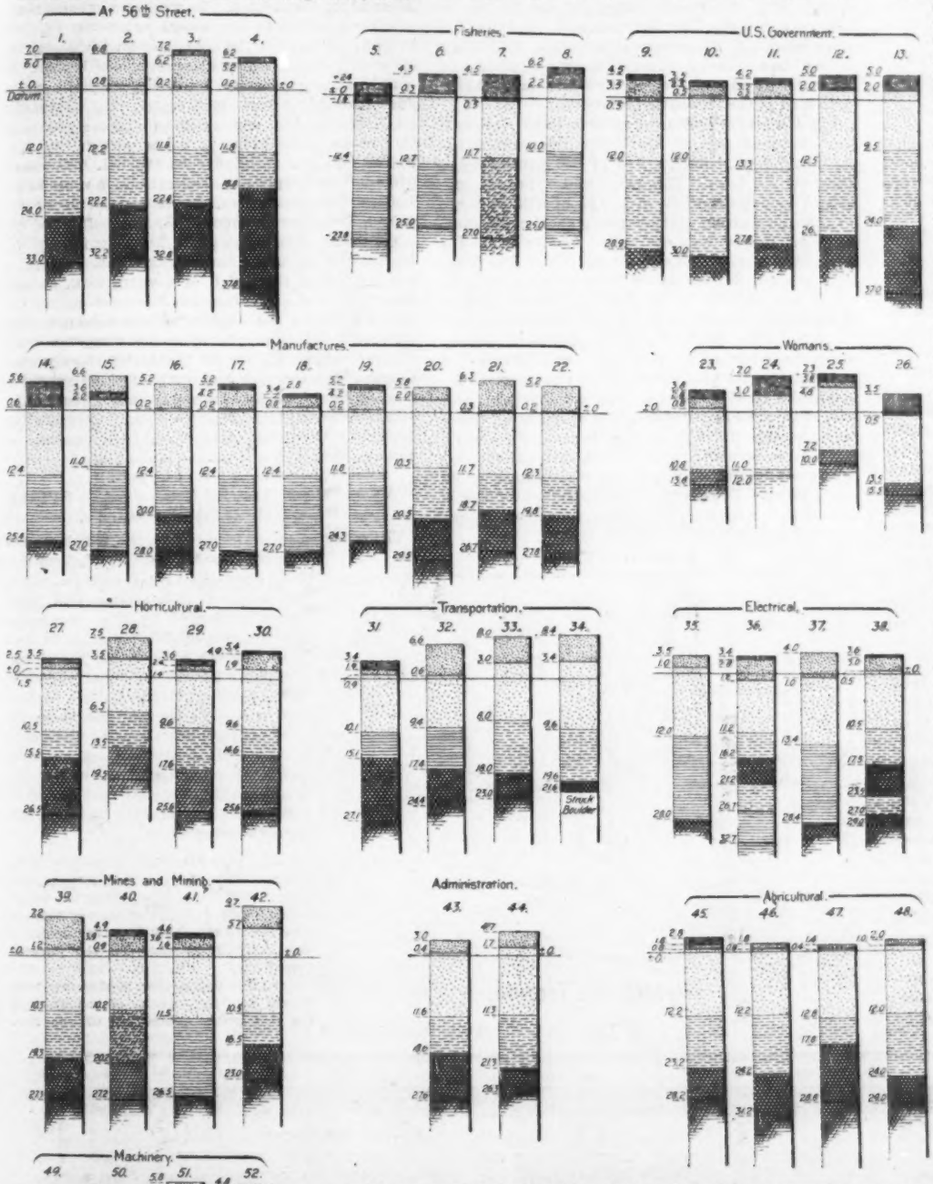
Symbols for Materials Shown in Sections of Borings.

The ultimate resistance of white pine and spruce against tearing, as given by various authors, is 10,000 to 13,000 lbs. per sq. in. Prof. Rankin in his "Applied Mechanics" gives it as 12,100 lbs. The tests by which the tensile resistance of woods were determined, were, of course, made on small specimens, as it is impracticable and difficult to test large sized pieces of timber for tension. Necessarily the results must be larger than if derived from tests of full sized pieces, as the small pieces do not contain as many imperfections as always occur in larger sizes. This was one of the reasons why in practice such a large factor of safety was adopted. Later and recent tests to determine the modulus of rupture and modulus of elasticity, by loading beams with transverse loads, have been made by Profs. Thurston, Lasiett, Col. Rodman and others, mostly also with small sized pieces. On full size beams valuable tests were made by Prof. Lanza, of the Massachusetts Institute of Technology, and also by a member of our own society, Mr. Onward Bates. I

shall proceed to review the results of some of their tests and their application to the case I treat upon. The mean modulus of rupture of spruce beams as determined by various authors is as follows:

Rankin	11,140 lbs per sq. in.
Hatfield	9,900 " " "
Laslett	9,045 " " "
Trautwine	8,100 " " "
Rodman	6,168 " " "

Col. Rodman's tests were made with larger sizes, hence



WORLD'S COLUMBIAN EXPOSITION; SECTIONS OF BORINGS AT JACKSON PARK, CHICAGO, SHOWING MATERIALS UNDERLYING THE SITE.

the smaller results than the others. From tests made by Prof. Lanza on full-sized joists of spruce from 2 by 12 ins. and 15 ft. in length and less, loaded in the middle and at other points, the modulus of rupture varies from 2,828 to 7,626 lbs. per sq. in., with an average of 5,046 lbs. derived from 68 experiments. The average modulus of elasticity was 1,332,451 lbs. Four tests were made with seasoned sticks; two of them had been seasoned for four years on the wharf and showed moduli of rupture of 8,748 and 7,562 lbs., and two were seasoned with steam heat in the laboratory for six months and gave moduli of 7,448 and 7,211 lbs., or about 45% larger than the average modulus for unseasoned timber. According to Prof. Lanza about the same modulus of rupture should be used for white pine as for spruce. In another table he gives the result of tests with beams varying in size from 4 by 12 to 6 by 12 ins., all 20 ft. long, in time tests, where the loads remained on the beams for some time, and while so loaded were seasoned by steam heat in the laboratory. Of 6 beams 5 were green timber at the beginning of the experiment, while the sixth piece had been seasoned on the wharf for six months. The average modulus of rupture for the five pieces was 6,337 lbs., while the modulus for the sixth piece was 8,547 lbs., or about 35% larger than the green pieces. In other time tests with spruce beams, all 18 ft. long, seasoned for six months in the laboratory, not loaded during seasoning, the average modulus of rupture was 7,300 lbs. per sq. in., modulus of elasticity 1,600,000. All these moduli of rupture are smaller than those obtained by other authorities from tests with smaller pieces, but they are more reliable; besides they prove that seasoned timber will stand more strain than green timber, from 30 to 45%, according to circumstances. Commenting upon the result obtained from his experiments, Prof. Lanza correctly remarks, that while it was necessary to use larger factors of safety, when the moduli of rupture were determined from tests with smaller pieces, it will be sufficient for most timber constructions, except in factories, to use a factor of four. For breaking strains of beams he also states most properly, that it is better engineering to determine as the safe load of a timber beam, the load that will not deflect it more than a certain fraction of its span, say about 1-300 to 1-400 of its length.

In order to determine the strength of our merchantable pine timber, as we obtain it from our lumber merchants, I had 33 pieces furnished to me by one of the lumber yards of this city, and tested in the Government testing machine in the Watertown Arsenal.

The pieces were 3 by 3 ins. pine, with small knots in them, and were cut from timbers 3 by 12, 3 by 14, 3 by 6 and 6 by 8 ins., by the lumber men, without any special directions from me, selected from the stock on hand without any particular care. The test pieces were turned down in the middle to a diameter of one inch. The first 19 pieces were from green lumber sawed this year; the last 14 pieces were from yard seasoned material. The ultimate resistance in the 19 green pieces was from 5,270 to 9,660 lbs. per sq. in., with the exception of two pieces, which were defective. Average for all 19 pieces, 6,681 lbs. persq. in. If the two defective pieces are omitted the average is 7,289 lbs. For the seasoned pieces the ultimate resistance varied from 6,640 to 10,210 lbs., one piece defecttive, average 7,720 lbs. per sq. in. If the one defective piece is omitted the average is 7,904 lbs. At the same time I obtained from the test records of the Arsenal an abstract of tests made in 1883 with pine blocks, tested with pressure across the fibre. The indentation produced at the surface of the timber was as follows:

Pressure,	846 lbs.	per sq. in., indentation,	0.01 in.
"	1,000 "	" " "	0.02 "
"	1,077 "	" " "	0.03 "
"	1,121 "	" " "	0.04 "
"	1,153 "	" " "	0.05 "

From which it will be seen that a pressure of 600 lbs. per sq. in. would produce an indentation on the blocks under the posts of the foundations of less than 1-100 of an inch. Coming back to the statement of Prof. Lanza, that it is better engineering to proportion floor beams with reference to their deflection, than to the ultimate strength, I have computed the deflection of a 2 × 12-in. joist, 14 ft. between supports, if loaded so as to produce a fibre strain of 1,500 lbs. per sq. in., using the modulus of elasticity of Prof. Lanza, 1,332,451 for green timber, and find the deflection to be 0.63 in., equal to 1-270 of the length, with the modulus as found for material seasoned without being subjected to loads, being 1,600,000, the deflection would be 0.45 of an inch, equal to 1-370 of the length. Most of the spans of joists in the exposition buildings are from 11 ft. 6 ins. to 12 ft. 6 ins. length; some few exceptions are over 14 ft. length.

I will briefly summarize the result of the various tests and the conclusions I arrived at.

First.—That the use of spread foundations upon the sandy bottom with clay substrata, as adopted, was warranted by the tests made with loaded platforms.

Second.—That the adoption of a strain of 600 lbs. per sq. in. for pressure of posts of foundations upon the blocking timbers, producing an indentation of less than $^1/_{100}$ in., would be justified even for permanent structures.

Third.—That the timber in floor joists and caps of posts, under the circumstances mentioned, must be considered as timbers seasoned, at the time when they will be called upon to do service; and seasoned without being subjected to loading.

Fourth.—That by using a working strain of 1,500 lbs. per sq. in. in the parts above named, if the test results of Prof. Lanza, for seasoned timber are accepted, a factor of safety from 4.8 to 5.8 is obtained; that if the results of the Watertown Arsenal are accepted, the factor of safety obtained from the 14 seasoned specimens show a factor of safety of 5.1. If the test results as given by Trautwine, Rankin, Hatfield and Laslett are accepted, the factor of safety would be still larger.

I will not omit stating that the question has been raised whether such material as has been specified in the specifications could be obtained in such large quantities as the immense buildings will require, and considering the time in which it will have to be furnished. I do not believe the point well taken. The specifications require sound white pine, free from wind shakes, rot and other defects impairing the strength of the timber, that only small and sound knots be accepted, and that small sap angles will be allowed in sizes over 12 ins. Such material has been growing for centuries, is growing to-day, and will in the future. A little care in selecting the material will furnish it; but if it should have been found impossible, considering the shortness of time, the remedy would be simple, and has been adopted, to my knowledge, often enough with steel or iron. If the material specified could not be obtained in quality, the contractor was allowed to substitute other material, increasing at his own expense the quantity to compensate for the deficiency in quality.

At the time of my resignation it had been ordered, without my consent, to increase the size of timbers in foundations and floors to such an extent as to reduce the pressure of posts upon blocking from 600 lbs. per sq. in. to 400 lbs.; and the fiber strain of joists and caps from 1,500 to 1,200 lbs. per sq. in.; the foundations were also reinforced. It will not be necessary for me to elaborate upon the fact that in trying to solve the problem before me, I did not consider how to reinforce anything, but to find what is right, necessary and sufficient under the conditions governing the case. Any structure, even the present floors, can be reinforced by adding material.

In conclusion, I will state, that as far as I know, an engineer had never before to solve a problem of this character, under the peculiar circumstances I had to deal with in this case, and perhaps no one ever will again. Buildings covering under their roofs hundreds of acres, to be used for six months only, and then be doomed to destruction; buildings erected from 1¼ to 2 years ahead of their use, an immense expenditure for a short temporary use of the buildings erected. That under such circumstances proper judgment ought to be exercised to combine the necessary strength, with the important fact of permissible economy, is evident, as well as the fact that ordinary practice will not apply in this case.

Electric Power Plant.

The following particulars are taken from the specifications issued by the Bureau of Construction for machinery and apparatus for generating electricity to operate motors in the principal buildings, proposals for leasing which machinery will be received by Mr. D. H. Burnham, Chief of Construction, until March 18. The machinery and apparatus will comprise generators, with or without motive power, and full complement of regulating and controlling apparatus for same. Also a switchboard, with all instruments, indicating and controlling apparatus, and conductors connecting the same with the generators. The furnishing of motors and external circuits, and connecting the latter to the switchboard, are not included in the specifications. The generators are to be of the direct current, constant potential type, and preferably shunt wound. The total capacity of plant in kilo-watts is 800 K-W. each for the Agriculture, Machinery, Manufactures and sundry buildings, 600 K-W. for the Mines and Mining Buildings, and 300 K-W. for the Transportation Building. The total capacity may be furnished by one or more generators, but the smallest generator supplied must have a capacity of not less than 100 K-W. for the 800 K-W. plant, 80 K-W. for the 600 K-W. plant, and 50 K-W. for the 300 K-W. plant. The electromotive force at the brushes when operating at maximum capacity and with minimum load will in all cases be 550 and 500 volts respectively. The generators must be so constructed that any number or all of them can be operated in multiple, and must be capable of developing the maximum output continuously for at least 15 consecutive hours without undue heating or sparking. They must be provided with insulating bases.

The foundations and the motive power, with connections to generator pulleys, will be furnished complete by the management, but generators designed to be attached direct to engine shaft must be furnished with the engine by the contractor. A suitable switchboard equipped with all the necessary instruments, regulating and controlling devices, and conductors for connecting same, is to be furnished in each case by the contractor, who must also furnish conductors for connecting the switchboard to generators. The switchboards are to be constructed wholly of non-combustible material, and all switches and safety fuses are to be mounted on non-combustible bases. If rheostats are furnished with generators, they are to be constructed with non-combustible frames or cases.

There is to be one direct reading ampere meter provided with each generator, to indicate continuously the current output, and one direct reading main line ampere meter for each of four feeders, which is to indicate continuously the current supplied to each feeder. One or more voltmeters are also to be furnished, to indicate continuously the E. M. F. at the switchboard. The conductors, instruments and appliances on the switchboard are to be so arranged that any number or all of the generators can be readily operated in multiple without interfering with the steady supply of current to the external circuit. The switchboard, with its full complement of instruments, switches, controlling devices and connections must be self-contained, and must be fitted and erected complete before being delivered at the Exposition grounds.

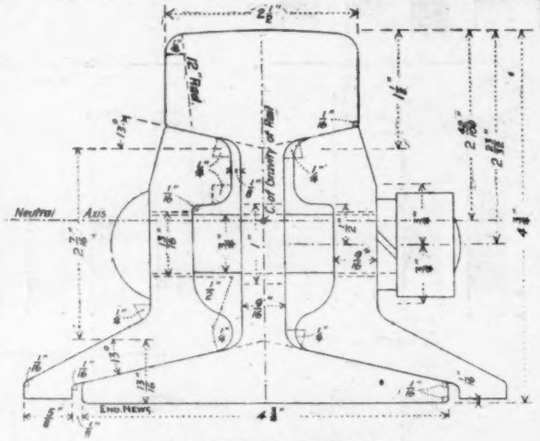
The machinery and apparatus is to be delivered free on board cars at the Exposition grounds not later than Sept. 1, 1892, a fine of $50 per day being imposed for delay. The labor and expenses connected with the erection of the plant will be borne by the Exposition management, each contractor, however, furnishing a competent man to direct the installation, operation and dismantling. The plant is to be accessible for public inspection, and may be listed and classed as an exhibit. All power and connections to same for driving the machinery, and all labor, attendance (except supervision already mentioned), and all oil and waste will be supplied by the management. The Chief of Construction reserves the right to operate the machinery at any load within the capacity specified at any or all times after the date of installation to the date of removal, and also reserves the right to transmit the current to any other point or points on the grounds or in the buildings. The plant will be placed on the south side of the Machinery Building, in the space reserved for electric light and power plant.

Boilers and Boiler Fixtures.

The Bureau of Construction will open proposals on March 8 for the complete installation of boilers, fixtures and appurtenances to supply steam to the Exposition. The contractor will provide for the delivery and erection of boilers having not less than 100,000 sq. ft. of heating surface, to be arranged in units of convenient size properly grouped, and guaranteed to be capable of the continuous evaporation of at least 450,000 lbs. of water per hour into commercially dry steam at a gage pressure of not less than 125 lbs. per sq. in. The boilers are to be complete, with foundations and all brick and iron work necessary for the installation of the plant ready for steam and water connections, also iron stacks and stack foundations, together with all necessary breeching and smoke flue connections. Oil burners of acceptable pattern are to be placed ready for connection to oil supply pipes, which connections will be made by the Exposition management. The contractor is also to furnish all necessary fittings and fixtures, tools and implements, and water tenders and firemen to run the plant, and must remove the entire plant after the close of the Exposition. The management will make the connections to the steam nozzles and to the water feed pipes at the boilers, and will furnish the pipe connections for oil supply to the boilers, but will be at no expense for operating the plant except for furnishing fuel and water, the contractor undertaking the management and maintenance. A portion of the plant is to be put in by Oct. 1, 1892, and the remainder by April 1, 1893. Each bid must be complete in all details and must be for boilers of the same class, that is water tube or fire tube boilers, but not necessarily for boilers of the same make. The entire plant, however, is to be installed and run under one management, subject to the control of the Chief of Construction, as the plant will be an exhibit, and it is expected that the prices made by the bidders will be nominal. The successful bidder will be required to furnish a bond of not less than $50,000 for the satisfactory performance of the contract, and to hold the Exposition management blameless from any damage caused by delay or failure of the plant to furnish steam when needed to the extent specified, and from breakage or damage caused by any failure of the plant.

STANDARD RAIL SECTION AND SPLICE BAR, FALL BROOK COAL CO.

The accompanying engravings, for which we are indebted to Mr. Robert H. Canfield, Asst. Supt., Fall Brook Coal Co., show the standard rail section and joint recently adopted by that company, which is of special interest, as it has been adopted after many years' experience with the roundest cornered rail in the world, the Lehigh Valley Sayre rail. Their experience seems to have satisfied them that the principle of this rail was wrong, as we fully believe all other experience will show, if sufficiently extended and properly analyzed. Mr. Canfield says, in an accompanying note:



STANDARD RAIL SECTION.

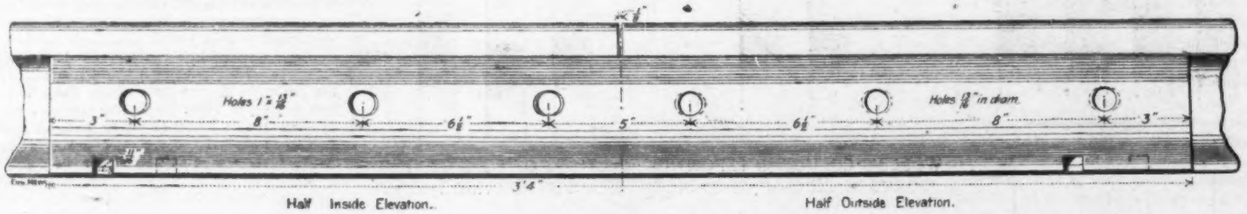
I send you drawings of the new 75-lb. rail and joint just adopted by this company. We have been using the Sayre pattern 76-lb. rail for a number of years in relaying tracks, and I have designed this rail to be used for this purpose hereafter.

You will notice that it conforms very nearly to the mean of suggestions for standards submitted to the Am. Soc. C. E. Committee on Standard Rail Sections, which you published March 21, 1891, but with a little larger percentage of weight in the head, this 75-lb. rail having a head almost precisely identical with the mean 80-lb. section then given.

Our fish-plates are 40 ins. long, resting on three ties, and fastened with six ¾-in. bolts.

The rails are being rolled by the Pennsylvania Steel Co. and the fish-plates by the Troy Iron & Steel Co.

To show how closely these two sections correspond we append the following comparative table, in which all those dimensions which, in the "mean" set prepared from suggestions to the committee, were constant for all sections, are first given, and afterward those which varied with each section.



Half Inside Elevation. Half Outside Elevation.

STANDARD SPLICE BAR; FALL BROOK COAL CO.

[Constant dimensions for all weights of sections]:	Mean. 75 lb. sec'n.	F. B. C. Co. 75 lb. sec'n
T. p radius	12 in.	1$\frac{6}{8}$ in.
Top corner and fillet radii	$\frac{1}{4}$ in.	$\frac{3}{8}$ in.
All other corner radii	$\frac{1}{8}$ in.	$\frac{1}{16}$ in.
Angle of under side of head and top of base	13°	13°
Per cent. metal in head	41.5	45.4
Per cent. metal in neck	21.	19.6
Per cent. metal in base	37.5	35.0
Sides of head, neck and base	Vertical	Vertical
Width=height?	Yes	Yes
[Variable dimensions]:		
Width of head	2 $\frac{7}{16}$ in.	2$\frac{3}{8}$ in.
Width of neck	0.60 in.	0.5625 in.
Width of base	4.833 ins.	4.75 ins.
Total height	4.833 in.	4.750 in.
Height of base	0.849 in.	0.812 in.
Height of neck	2.563 in.	2.438 in.
Height of head	1.421 in.	1.500 in.

It will be observed that all the constant dimensions are the same, except the percentage of metal in head, neck and base. The F. B. C. Co. section takes about 7% of the metal in both neck and base to add it to the head.

The head is then made $\frac{1}{16}$ in. wider, and 0.079 in. higher. The neck is thinned 0.0375 in., and shortened 0.125 in. The base is narrowed 0.083 in., and lowered 0.037 in. The differences, of course, are not worth talking about from one point of view, but the policy of increasing the weight of the head from 41½ or 42% to 45½% will be questioned. Under the "wear" theory, that the more metal in the head the more to be worn off and the longer the rail will wear, the section is, of course, improved; but under the opposite theory, which is now the most generally accepted one, that the heavier the head is in proportion to the base the hotter it will be when rolling is finished, the less will be the proportion of the total work of the rolls expended upon it, and hence the "punkier" and sooner injured the metal, the gain is more doubtful.

The joint is another evidence that the six-bolt angle bar resting on three ties is making a pretty good record for itself and giving general satisfaction. Whether it is the last word on joints, however, we have our doubts. The principle of the Fisher bridge joint, if not its precise form, would seem to promise more permanent benefits.

A LEVEL TRUSS BRIDGE WITH INCLINED FLOOR.

We illustrate in the accompanying cut a novel style of bridge designed and built by the Missouri Valley Bridge & Iron Works, of Leavenworth, Kan., for the United States Government, at Fort Riley, Kan. The structure crosses the Kansas River, and has a main span of 250 ft. It is built entirely of steel, and was erected under the direction of Capt. Geo. E. Pond, A. Q. M., U. S. A.

The point of interest is the novel arrangement of the floor system, which enables the difference in elevation between the banks of the stream to be overcome without raising the trusses to an unnecessary height above the stream, and does away with the construction of expensive approaches which would be necessary if the floor was on a level. This arrangement is plainly shown in the cut. The trusses are of the ordinary Pratt type, supported on iron cylinder abutments, and the floor beams are fastened directly to the posts at heights above the lower chord varying sufficiently to secure the necessary incline for the floor. There is the usual lateral system of sway bracing between the floor beams, and in addition there is a system of vertical bracing at the posts, giving the structure some of the advantages of a deck bridge in stability. It would seem as if this style of floor might be used to advantage in many cases, especially for foot bridges and high way bridges with a light traffic.

HIGHWAY BRIDGE OVER KANSAS RIVER, FORT RILEY, KAN.; Missouri Valley Bridge & Iron Works, Engineers.

THE PROGRESS OF IRRIGATION IN THE UNITED STATES.

The progress of irrigation in the United States and some valuable information as to its present status are set forth in a commendable manner in the February number of the "Irrigation Age," noticed in our issue of Feb. 27, 1892. Irrigation in the United States as a whole is discussed by Mr. R. J. Hinton, of Washington, D. C., and irrigation in the several states by eminent engineers and irrigators. An abstract of the most salient features in these articles is given below.

The United States.

The status of irrigation in the United States, as shown by areas under ditch and cultivated in 1891, and the number of artesian wells in existence for the several states where irrigation is practiced, is given by Mr. Hinton as follows, the column of percentages being added for convenience:

States and territories.	Estimated acreage in 1891: Under ditch.	Under cultivation.	P. c. of acreage under ditch cultivated.	No. artesian wells, 1891.
Arizona	663,000	315,000	41	42
California	4,500,000	3,550,000	79	3,500
Colorado	3,097,050	1,800,000	60	4,500
Idaho	1,500,000	330,000	28	12
Kansas, west of 97° long.	900,000	120,000	13	250
Montana	1,250,000	110,000	33	36
Nebraska, west of 9.° long	200,000	40,000	20	100
Nevada	150,000	75,000	50	76
New Mexico	700,000	465,000	66	10
North Dakota	2,500	2,000	80	670
Oregon, east of Cascades	125,000	45,000	36	9
South Dakota	100,000	54,000	54	950
Texas, west of 97° long.	350,000	157,000	46	1,000
Utah	735,000	423,000	57	2,524
Washington, east of Cascades	175,000	75,000	43	10
Wyoming	3,031,484	185,000	6	6
Total	18,533,107	8,031,000	43	13,690

These figures are from the forthcoming report of the Irrigation Inquiry, U. S. Department of Agriculture, Mr. Hinton being in charge. The report is now in the hands of the public printer. All of the figures are estimates, to a greater or less extent, Colorado and Wyoming being the only states having official statistics of value. It is thought, however, that the figures are too low rather than too high.

As will be seen from the above table, California leads in acreage under ditch and cultivation, as would be expected in view of the irrigation activity in that state for several years. Wyoming has some 25,000 acres more under ditch than Colorado, but only 6% of Wyoming's acreage, or 185,000 out of 3,031,000 acres, is under cultivation. In this respect Wyoming makes the poorest showing, but Wyoming is a great stock raising state, and may irrigate some grazing land.

Omitting North Dakota, because of the small areas in question, California has the largest percentage 79, of land under ditch also under cultivation.

In number of artesian wells Colorado leads with 4,500 and California follows with 3,500. Until recently it was doubtful whether artesian wells could be secured in either Arizona or New Mexico, but now Arizona has 42 and New Mexico 10. The first well in Arizona was successfully completed in 1889 on a ranch in the San Simon Valley.

In South Dakota the state engineer has examined and approved sites for 100 township wells, bonds for which have been issued, under the Melville act, and has applications for many more examinations. These wells are proposed by the townships in which they are located. Only a few have been put under construction. South Dakota has over 100 deep, flowing wells.

The progress in the United States as a whole is considered by Mr. Hinton as very gratifying. We may now pass to a brief review of irrigation in the several states and territories.

Arizona.

Arizona has to-day the remains of irrigating canals and reservoirs constructed and used many years ago. In fact, Mr. Lincoln Fowler, in his article on Arizona, states that Arizona is the oldest irrigated region in the United States. The first extensive modern irrigation work in Arizona seems to have been begun in 1867, when construction of a canal from the Salt River, to cover the present site of the territorial capital, Phoenix, was begun by Darrel Duppa agd Jack Swilling. These works followed the line of a prehistoric system. The principal works in the territory are briefly described by Mr. Fowler. Oranges, apricots, olives, grapes, citrons and pomegranates are now raised in Arizona, climate and soil, it is claimed, being eminently suited to the growth of these fruits when water is applied. Alfalfa and cereals are also raised with great success.

California.

Mr. Geo. F. Weeks, in his review of irrigation in California, claims that the state owes the larger part of its present prominence to irrigation. The rude irrigation methods in connection with the mis-

sion stations were followed by many of the earlier settlers in California, and the mistakes thus made have been a great drawback, particularly in the excessive use of water. After years of mistakes, followed by experiments and successes, more scientific irrigation is now to be seen in California, it is probable, than elsewhere in this country. Pipe systems for supply and distribution, cement and brick lined canals, improved canals with better alinements and grades, immense storage reservoirs—all these factors have been brought into play. Artesian wells, tunnels and submerged dams have been used to develop water; irrigation districts have been formed to aid small landowners in co-operative attempts to secure water. Of these irrigation districts, the principles and practices of which have often been described in these columns, there are now 38 in California, and others are being organized. The Wright Irrigation District Act only went into operation in 1887, and all of these districts have been organized since. Many of them are not yet in operation, and some have not yet voted bonds, but all have projects of greater or less extent under way.

Private enterprise in California has constructed the Great Bear Valley and Sweetwater reservoirs and irrigating systems. The Kern County Land Co. has 300 miles of main canals and some 1,100 miles of laterals, the laterals being distributing canals from 10 to 25 ft. wide feeding many hundreds of miles of smaller ditches.

Colorado.

Colorado, as a state, has given more systematic and intelligent consideration to irrigation than any other state in the Union. California began well some years ago, but for political or parsimonious reasons, or because of opposition from mining interests, we cannot say which, but suspect each, let several years pass without doing much, as a state, to advance irrigation interests. The Wright Act, mentioned above, is again bringing California to the front, but the state still lacks, so far as we can learn, that intelligent supervision and direction of irrigation interests which is given by the State Engineer's office of Colorado and Wyoming.

A large number of storage reservoirs have been built in the state, and there are numerous projects for additional ones. All the storage reservoir dams, save the Castlewood, Prof. L. G. Carpenter states, are earth. Here, as in California and Arizona, pumping of has been used to a limited extent to lift water onto land not otherwise within the reach of irrigation.

Kansas.

Irrigation was first introduced in Kansas in 1880, at Garden City, in the southwest part of the state. Artesian wells and water derived from the "underflow" have been utilized to some extent. Doubtless there would have been much more irrigation progress in Kansas, Nebraska and the Dakotas had not the people of these states been inclined to resent, in former years, the idea that irrigation was needed. Several notable systems have been constructed in Kansas, as will be the better understood from the following figures: Eleven canals, owned by ten companies, have a combined length of 424 miles of main and 526 miles of lateral canals; they irrigate 35,800 acres and cover 256,000 irrigable acres; their cost, as represented by capital invested, has been $2,882,000, or an average of about $11 per acre. It is not stated whether the laterals include the small or farm ditches, but it is supposed that they do not.

The South Dodge Canal Co., operating in Ford County, derives its water supply wholly from the underflow. A part or all of this supply has been developed by the so-called "fountain" method; that is, by dredging a ditch about one and one-fourth miles long in saturated sand and walling out the sand, where necessary, by sheet-piling. This "fountain" is an outgrowth of a theory advanced by the writer of the article on Nebraska, Mr. J. W. Gregory.

The last session of the Kansas legislature passed a comprehensive irrigation law, which, among other things, provides for the formation of irrigation districts. Under this law districts have already been formed in Hamilton, Finney and Ford counties, but actual construction of irrigation works has not yet been started by any of the districts.

Montana.

Montana, according to Mr. Wm. F. Wheeler, is first a mining, second a stock raising, and third an agricultural state. The first canals built in the state were for mining purposes, there being a large number of these built between 1862 and 1869. At the close of 1869 there were 288 miles of these ditches, with a combined capacity of 25,370 miner's inches (6-in. head) and having cost over $800,000.

It is estimated that 80% of the agriculture of the state is aided by irrigation. Most of the ditches are small. There seems to be a great field for irrigation development in the state.

Nebraska.

In 1891 Nebraska had a good rainfall, there being 7 ins. in the month of June. Nevertheless, states Mr. L. E. Hicks, the interest in irrigation has been well maintained and there are many well conceived projects on foot. The greatest activity is in the Republican and North Platte Valleys.

The greatest event of the irrigation year in Nebraska was putting under construction of the ditch of Farmer's Canal, which is projected to extend entirely across Scott's Bluff and into Cheyenne Co., a total length of about 120 miles. A section of this canal is under construction. D. D. Johnson of Gering is secretary of the company, Mr. A. B, Wood was associated with Mr. Hicks in the preparation of the article on Nebraska.

New Mexico.

New Mexico seems to be making rapid progress in the reclamation of its dry lands and the construction of extensive works. Irrigation here, as in Arizona, has been practiced for centuries. Fray Marcos de Nija, said to be the first European to visit New Mexico, has left some pleasant remarks regarding a village which he saw in 1539 "supplied with an abundance of water conveyed thither by artificial means." He also speaks of traveling for five days through "a valley well watered and in a high state of cultivation so that," he adds with the thought of a general, "3,000 horsemen might have been sustained there."

At present about 250,000 acres, Surveyor General E. F. Hobart estimates, are irrigated by the old Spanish system, the farmers living together in houses clustered about a plaza, and owning strips of land running back from the river and watered from a ditch taken from it. The largest ditch after the old plan, is at Las Cruces, and is about 12 miles long and 15 ft. wide. Water is turned into it by means of a temporary dam.

Large storage reservoirs, submerged dams and artesian wells are projected and under construction to conserve and develop water and add to the number and extent of modern systems.

An iron flume is in use on the Vermejo low line ditch near Maxwell City, and is shown by an illustration accompanying Mr. Hobart's article. A similar flume, if not the same, the Laybourn, was described and illustrated in our issue of Oct. 17, 1891.

Nevada.

Considering the area available for development by irrigation Nevada seems to have made but little progress. Mr. C. W. Irish, in his article, accounts for this largely by the absence of proper state legis lation. At present there seems to be no restriction to the amount of water which a person many appropriate, and thus much water has been appropriated by those who cannot or will not use it. Irrigation of farms by the aid of small reservoirs seems to have been successful.

Idaho.

Irrigation progress in Idaho is reviewed by Messrs. A. D. Foote, I. N. Hart and W. A. Soulder. The greatest development has been in the Snake River Valley, and there yet remains much that may be done here. In the Payette Valley considerable has been done and much more is promised. In 1891 the first car load of prunes ever exported from Idaho was shipped from the orchard of Mr. N. A. Jacobsen, who has a large pru ne orchard in this valley.

Oregon.

It is stated by Mr. F. H. Brigham that agriculture in Oregon has gone as far as it can without the aid of irrigation, all the lands not needing an artificial water supply now being occupied. All of that part of the state east of the Cascade Mountains, 35,000,000 acres, with slight exceptions, needs irrigation, and but 115,000 acres are now under water. A dam 147 ft. high and 600 ft. long at the crest, to be built of basaltic rock, is projected by the Baker Valley Irrigation Co., to be located on the Powder River in Baker Co. This company has an authorized capital stock of $1,000,000, and has expended about $10,000 in engineering work.

Utah.

The history of irrigation in Utah has been coincident with the history of Mormonism until comparatively recent times. The Mormons reached Utah in 1847 and a quotation from the diary of "Apostle" Orson Pratt for July 23, 1847, shows that irrigation began immediately upon their arrival. The extract is as follows:

> In about two hours after our arrival [in the Salt Lake Valley] we began to plow, and the same afternoon we built a dam [across City Creek] to irrigate the soil which at the point we were plowing was extremely dry.

In the diary of "President Wilford Woodruff for July 25, 1847, two days after the above incident, it is stated that water had already been spread over the newly plowed land.

Triangular frames with plumb bobs suspended from the apex; bottles attached to rods and milk pans filled to the brim with water to serve as levels; these were some of the surveying instruments used by the pioneer Mormons.

The Ute Indians, Mr. Calvin Reasoner states, once established ditch lines in a novel way, merely by diverting from a stream through the small channel made by a stick a stream of water, and carrying this channel as high as the water would flow. This small channel, or scratch in the surface, was afterward enlarged.

The Bear River Canal is probably the largest irrigation work under way in Utah, the irrigation of 200,000 acres being included in the project. There will be two main canals, one 40 the other 50 miles long. The Oquirch Water & Land Co. proposes to irrigate 40,000 acres in the vicinity of Salt Lake City.

Washington.

Washington has the promise of a great irrigation future. Irrigation has been practiced on a small scale for twenty years and within the last year or two several large projects have been put under way. The State is well watered by the Columbia, Snake and Yakima Rivers. No water has yet been drawn from the Columbia River, according to Mr. L. S. Howlett, owing to the depth of its surface below the surrounding country. Surveys have been made for ditches in Yakima and Douglas counties to utilize the Columbia, and irrigation from its mighty volume is doubtless only a question of time.

The Northern Pacific, Yakima & Kittitas Irrigation Co. has recently completed 17 miles of a canal which it proposes to extend to 50 miles and from which it intends to supply water to 80,000 acres. Reservoirs have been constructed already. It is said that during the coming season the company will expend $500,000 in construction. Mr. C. E. Rockwood is engineer.

A company has been formed at Yakima to develop water for irrigation from artesian wells. Already two wells have been sunk, the first having a daily flow of 650,000 gallons. A. K. Hiscock is interested.

Washington, as well as California and Kansas, has provided by law for the establishment of irrigation districts. Some of these have been formed in Kittitas and Yakima Counties, and in Kittitas County contracts for construction have been let.

Wyoming.

Wyoming is following the example of Colorado in its stand as a state. It has passed excellent irri gation laws, and the office of the state engineer is busily engaged in securing the information and making the necessary surveys for intelligent management of the conservation and distribution of the waters of the state. During 1891 there were filed in the state engineer's office, statements, in accordance with the law, regarding 220 projected ditches, with a combined length of 170 miles, designed to water 856,700 acres at an estimated cost of $3,464,260. The estimated cost of five of these ditches, range from $2,000,000 to $100,000 and their proposed length from 150 to 24 miles. The combined length of these five ditches, out of 222 projects, is 317 miles, and their total estimated cost is $2,628,000. Mr. P. L. Naismith, Assistant State Engineer, says that these projects represent opportunities rather than actual ditches, having in mind, as one may judge from the context, that some of the land in question is still owned by the general government, and that cession to the State is necessary before large projects can be successfully carried out under proper restrictions for the welfare of the people.

APPARATUS FOR REGISTERING THE SPEED OF TRAINS.

This apparatus, described in the "Revue Générale des Chemins de Fer," of September, 1891, is made by Richard Bros., of Paris, and is in use on the Orleans Railway, of France. It is portable, and can be quickly applied at any point desired.

The principle of the apparatus is very simple. The paper register is wound about a vertical cylinder (C), Fig. 1, and attached to this cylinder is a clock-movement causing one revolution in 24 hours. A second clock-movement (H) gears with the wheel (R) with a grooved rim, and has a speed of one turn in 2½ minutes. A free axle, in the line of that of the wheel, carries at one extremity the cross-bar (T) and at the other end the stylus (L), on which latter is a pen (m), that in moving traces a curved line upon the registering cylinder. In its normal condition the arm (L) remains inclined by its own weight, with the pen at the base of the cylinder. But as soon as the cross-bar (T) is pressed upon the wheel (R) by the armature of the electromagnet (E), the arm (L) is lifted and the register is made. The arm falls by its weight as soon as the current is broken.

At two points in the track, about 328 ft. or 100 m. apart, are placed two electric pedals, sensible to the first contact of the train and so mounted that the first pedal sends a current into the electromagnet E and the second pedal breaks the current. The trace upon the registering cylinder, made by the action of the temporary current, is proportioned to the time in which the train passes the 100 m. course, and is inversely proportioned to the speed of the train.

With the dimensions adopted in the machine shown, speeds of 18.6, 39.2 and 55.8 miles per hour are represented by ordinates of a length of 3.5, 1.75 and 1.17 ins. on the registering sheet. Experiments prove that velocities up to 50 miles per hour can be registered with an error of 3 to 4%.

If a good time-pedal is on hand it may be applied to this machine, with one minute interval in sending and breaking, and the two electro-magnets (S^o) and (S^f) and the oscillating armature (A) are attached for the use of such pedals. If you suppose that the two track pedals (P^o) and (P^f) operate by emission, then the pedal at the entrance (P^o) is united by a wire to the electro (S^o) and the other pedal is in the same way connected with (S^f). The first contact with (P^o) then sends a current to (S^o), and this rocks the oscillating armature (A) and shifts the commutator (i) from (a) to b). At (a) the commutator rests upon an insulated plate, and at (b) it forms a circuit with the electro-magnet (E), and through the latter gives motion to the stylus (L). If the train is longer than the interval between the track-pedals, these will be attacked almost simultaneously, But these alternating attacks have no other effect than to cause the pen to oscillate at the bottom of its path. When the pen touches the top of the sheet the stylus closes an electric contact (r) (Fig. 1), which sends the current into electro (S^f) and as a result causes the commutator (I) to shift and break the circuit, and the pen falls This limits the speed observations to a velocity exceeding 17 miles per hour.

Fig. 3 shows a record taken from the single track line between Brive and Toulouse. This apparatus was arranged to register the speed of the even trains, the odd trains are shown by a complete trace which represents the hour of passage and not the velocity of the train. The whole registering device is covered with a light metal box, and it weighs about 15 lbs. A pile of eight Leclanche elements is sufficient for the operation of the apparatus.

For fixed installation and for closer work the Baillehache pedal is recommended as shown in Figs. 4, 5. An electric circuit leaving the earth and traversing a pile, ends in an isolated steel plate M, 2.16 ft long by 1.03 ft. wide, and 0.2 ins. thick, fixed along the track on the outside. The edge of this plate is some millimetres from the rail and is slightly higher than the head of the rail, so that the tire of the passing wheel will touch and bend it down. Through this tire electric connection is made with the wheel or the earth, which closes the circuit and establishes a current during the time of contact.

The practical difficulty to be overcome lies in giving sufficient flexibility and resistance to the plate (M), and assuring its insulation. This end is accomplished by laying a wooden sill, (B), parallel to the rail and connecting this to the cross ties by angles and bolts. On this sill are placed successively two plates of rubber, (C^1) (C^3), the steel plate (M), two more rubber plates (C^2), (C^4), and finally the two angle-irons (R^1) (R^2), somewhat longer than the steel plate. These five plates are all firmly fastened to the wooden sill by the four bolts passing through the angles and the sill. Several small rivets with projecting heads prevent the rubber from slipping on the steel plate. A cover of galvanized iron, (N), protects the rubber plates against the sun and rain and also covers the wire connection. An experience of several years shows that this pedal works with remarkable regularity with the sole condition that the edge of the plate be cleaned once or twice per week. Its stability and the isolation of the plate were very satisfactory. About 30 of these pedals are installed on the line of the Orleans Railway.

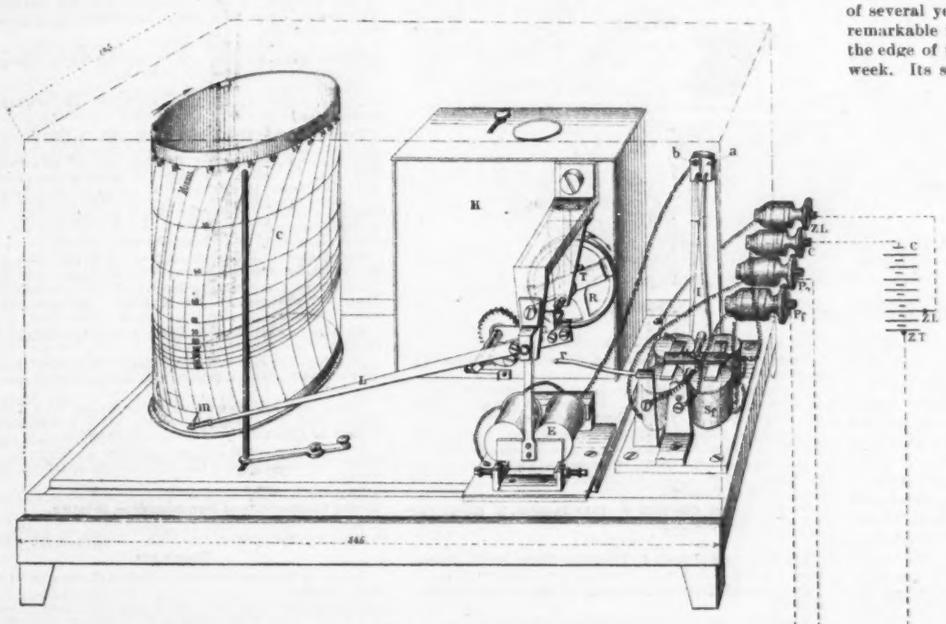


FIG. 1. PERSPECTIVE VIEW OF SPEED RECORDER FOR TRAINS.

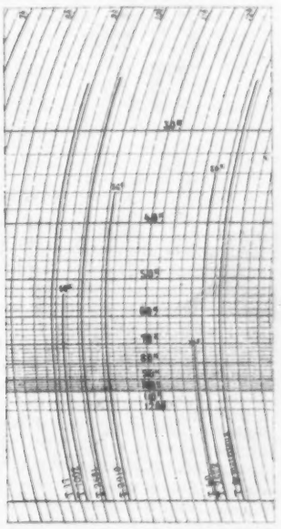


FIG 3. PORTION OF RECORDED DIAGRAM.

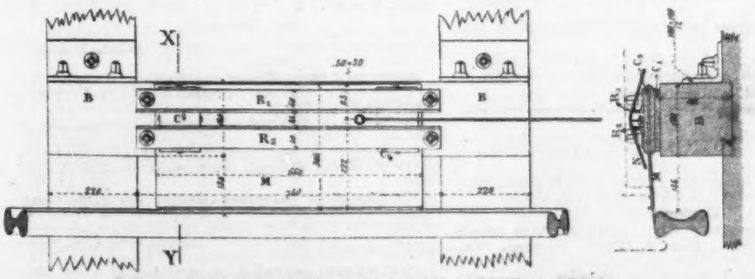


FIG. 4. PLAN AND CROSS SECTION OF OPERATING PEDAL.

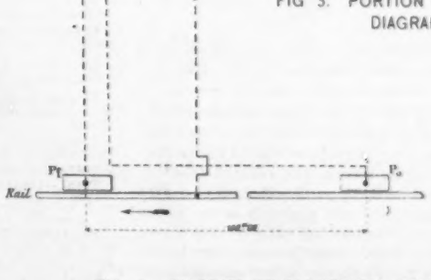


FIG 2. DIAGRAM OF ELECTRICAL CONNECTIONS.

BOILER EXPLOSIONS IN GERMANY IN 1890.

For the year 1890, 14 boiler explosions are recorded in Germany. In 2 cases incrustation of the boiler is given as cause, 2 low water, 1 too high tension in boiler, 5 local weakening of shell, 2 wear and age of boiler, 1 an old crack and 1 poor material of a boiler-tube.

According to the types of boilers these accidents are divided as follows:

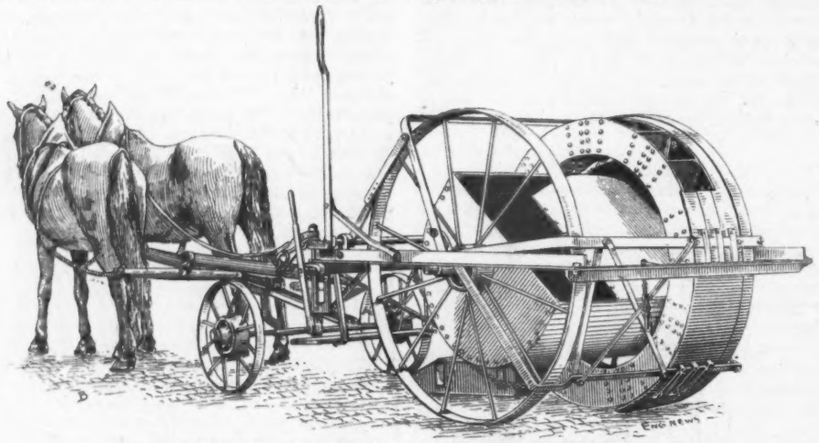
Horizontal single flue boilers	2	explosions.
" 2 or more flue boilers	6	"
" portable engine boilers	4	"
Upright firebox boilers	1	"
Multitubular boilers	1	"

The number of injured persons is 18, of which 7 were killed, 11 slightly wounded, against 28 persons injured at the 16 boiler explosions of 1889.

MACHINE FOR PICKING UP STREET SWEEPINGS.

This machine is constructed for the purpose of picking up moist street sweepings or mud, which have been deposited in streaks by the preceding sweepers, according to the "Zeitschrift fuer Transportwesen und Strassenbau," to which periodical we are indebted for the following description.

The frame of this machine carries suspended from the rear axle an iron trough of half cylindrical shape, about 4 ft. in length and nearly 3 ft. wide. At the inside of the rear wheel an open paddle wheel is attached. It is 12 ins. wide, with a diameter 2 ins. smaller than that of the former. As the machine rolls along above the strip of sweepings,



MACHINE FOR PICKING UP STREET SWEEPINGS.

the paddles of this wheel will raise them along the inner side of the movable sheet-iron strap, which is adjusted at the rear of the paddle wheel and is curved to conform with the circumference of the wheel. When the sweepings have been raised to a level with the axle they drop through the open paddle wheel into the trough beneath. A small plow at the front serves to narrow the strip of sweepings, which may perhaps have been scattered somewhat by the hoofs of the horses drawing the machine. When the trough is filled it is dumped by means of a crank with chain, at the place designated. It is asserted that with this machine, which is drawn easily by two horses, one man can remove from four to six miles of double rows of sweepings in a day. The inventor and patentee of this machine is Ludolf Walter, Alvensleben, Saxony.

STATISTICS SHOWING THE PROSPECTIVE RAILWAY CONSTRUCTION OF 1891.

[With Map No. 41.]

In the following list it has been our intention to include all lines of railway which have some fair prospect of being completed or placed under contract or construction during the current year. It should not be understood from this that all or nearly all of the following lines will probably be put under construction during the coming year, neither do we mean, on the other hand, that the enterprises below described have a mere fighting chance of beginning actual work during 1892. The list presents simply a fair statement of the lines on which engineers and contractors have a prospect of securing work during the coming season. It is presented, of course, with no such claims to accuracy as we make for our statistics of actual tracklaying, nor is it by any means so full and accurate as our sectional maps, since it is made up largely from reports made some time ago. It will be found more accurate also, we presume, with regard to independent enterprises than with regard to the extensions of the large systems, erring somewhat by omissions with regard to the latter. Used with these precautions we trust the map and list will prove a valuable guide to our engineer and contractor readers in planning the coming season's work. Concerning the many enterprises omitted from the map and list as having little or no prospect for actual work during 1892, we shall be pleased to receive further details giving additional reasons for their inclusion; and in a like manner any which may be wrongly included or wrongly described in the following list we shall be pleased to correct upon receipt of well attested information.

NEW ENGLAND.

Maine.

Bangor & Aroostook.—Located, Brownsville to Houlton, 90 miles. Pres., A. A. Burleigh; Ch. Engr., Moses Burbee; both of Houlton.

Castine Ry. & Nav. Co.—Surveyed, Castine to Milo, 81 miles. Pres., A. M. Devereaux, Bangor.

Portland & Rumford Falls.—Under construction, Gilbertsville to Rumford Falls, 14.6 miles.

Skowhegan & Norridgewock.—Under contract, Skowhegan to Norridgewock, 5.5 miles. Ch. Engr., Fred. Danforth, Gardiner.

Total.—Under contract or construction, 20 miles. Surveyed or under survey, 171 miles.

New Hampshire.

Boston & Maine.—Surveyed, Canaan to Fairlee, Vt., 20 miles.

Brookline & Pepperill.—Under construction, Brookline to Groton, 11 miles. Pres., Franklin Worcester, Balls. Ch. Engr., Aug. W. Locke, North Adams, Mass.

Concord & Montreal.—Under construction, Jefferson to Berlin, 17 miles. Surveyed, Epping to Exeter, 13 miles.

Moosilauke.—Surveyed, Warren Station to Moosilauke, 20 miles. Pres., John H. Pearson; Ch. Engr., F. W. Conn, both of Concord.

Total.—Under contract or construction, 21 miles. Surveyed or under survey, 53 miles.

Vermont.

Black River.—Located, Proctorsville to North Springfield, 5 miles. Ch. Engr., Geo. A. Ayre, Perkinsville.

Clarendon & Pittsford.—Surveyed, Proctor to Brandon, 13 miles.

Total.—Surveyed or under survey, 18 miles.

Massachusetts.

Boston & Maine.—Under construction Stoneham Center to Fells Sta., 3 miles.

Concord & Montreal.—Surveyed, North Acton to Belmont, 16 miles.

Fitchburg.—Projected, Marlboro to quarries, 2 miles.

Old Colony.—Surveyed, Norwood to Dedham, 6 miles.

Plymouth & Middleboro.—Under construction, Plymouth to Middleboro, 16 miles. Pres., T. D. Shumway, Plymouth.

Southbridge, Sturbridge & Brookfield.—Projected, Brookfield to Sturbridge, 13 miles. Ch. Engr., Arthur C. Moore, Sturbridge.

Total.—Under contract or construction, 26 miles. Surveyed or under survey, 22 miles. Projected, 15 miles.

Connecticut.

Westerly & Jewett City.—Surveyed, westerly to Jewett City, 28 miles. Pres., Alex. H. Briggs, Ashaway. Ch. Engr., Wm. G. Smith, Waterbury.

Total.—Surveyed or under survey, 28 miles.

MIDDLE.

New York.

Cumberland & St. Lawrence.—Under construction, Malone to Poland, 115 miles.

Cooperstown & Charlotteville Valley.—Surveyed, West Davenport to Davenport Center, 3 miles.

Dunderburg Spiral.—Partly graded, gravity railway at Mt. Dunderburg, 15 miles.

Lehigh Valley.—Rochester Branch.—Tracklaying in progress, end of '91 track to Rochester, 4 miles. Geneva & Van Ettenville R. R.—Under construction, Geneva to point 5 miles north of Van Ettenville, 52 miles.

Little Falls & Dolgeville.—Graded, Little Falls to Dolgeville, 12 miles. Alfred Dolge, Dolgeville.

Ulster & Delaware.—Located, Bloomville to Oneonta, 22 miles.

Total.—Under contract or construction, 195 miles. Surveyed or under survey, 25 miles.

New Jersey.

Lake Hopatcong, Boonton, Morristown & Caldwell.—Located, Caldwell to Rockaway, 47 miles; branch to Morristown, 7 miles. Sec., H. Reynolds, Whippany. Ch. Engr., C. C. Vermeule, 71 Broadway, New York City.

Raritan River.—Partly graded, New Brunswick to Bound Brook, 7 miles.

Rockaway Valley.—Surveyed, Mendham to Morristown, 8 miles.

Total.—Under contract or construction, 7 miles. Surveyed or under survey, 22 miles.

Pennsylvania.

Altoona & Wapsononock.—Surveyed, Highlands to Frugality, 7 miles. Ch. Engr., W. T. Forsyth, Altoona.

Baltimore & Ohio.—Under construction, Uniontown to quarries, 3 miles. Projected, Fairview to Middletown, 20 miles.

Beech Creek.—Under construction, Friendship Tunnel to Mahaffey, 15 miles.

Buffalo & Susquehanna.—Under construction, Galeton toward Cherry Springs, 7 miles. Surveyed, 7 mile post to Cherry Springs, 5 miles. Pres., F. H. Goodyear, Austin.

Buffalo, Rochester & Pittsburg.—Under construction, Howard Junc. to Mt. Jewett, 19 miles.

Cammal & English Center.—Under construction, Cammal to English Center, 12 miles.

Coudersport & Port Allegheny.—Surveyed, Sweden Valley to Ansonia, 33 miles.

Cumberland Valley.—Surveyed, Ft. Loudon to Mt. Dallas, 46 miles.

Emporium & Rich Valley.—Under construction, Big Run to county line, 3.5 miles. Ch. Engr., E. H. Welch, Emporium.

Erie & Wyoming Valley.—Surveyed, Hoadleys to Honesdale, 5 miles.

Hunters Run & Slate Belt.—Under construction, Pine Grove Furnace to slate quarries, 5.5 miles. Pres., J. C. Fuller, Pine Grove. Ch. Engr., A. E. Lehman, 711 Walnut St., Philadelphia.

Lancaster, Oxford & Southern.—Surveyed, Quarryville to White Rock, 9 miles; Oxford to Singerly, Md., 14 miles. Ch. Engr., S. C. Slaymaker, Lancaster.

Lehigh Valley.—Surveyed, Bernice to Nordmont, 8 miles. Projected, Berwick to White Haven, 25 miles; extension to Scranton, 2 miles.

Pennsylvania—Track laid since Jan. 1, 1892, Kaylor to Brubaker, 20 miles. Under construction, Chestnut Hill to Ft. Washington, 6 miles; Trenton Cut-off to Swedeland Furnace, 1.5 miles; Pottsvile to Minersville, 7 miles; Mann's Choice to Brooks' Mills, 50 miles; Fairchance to Morganstown, 19 miles. Located, Tower City to Brookside, 1.5 miles. Surveyed, Murraysville to Delmont, 6 miles; Germantown to Trenton Cut-off, 10 miles. Projected, Bustleton to Trenton Cut-off, 8 miles.

Perry County.—Tracklaying in progress, Nelsons to Loysville, 7 miles. Ch. Engr., Jas. Elliott, Jr., Bloomfield.

Pittsburg, Cannonsburg & State Line—Located, Pittsburg to Wellsburg, W. Va., 35 miles. Pres., A. E. Succop, Pittsburg.

Pittsburg, Shenango & Lake Erie.—Graded, E. & P. Junc. to Conneaut, O., 10 miles.

Reading, Lancaster & Baltimore.—Projected, Reading to Perryville, Md., 70 miles. Ch. Engr., S. C. Slaymaker, Lancaster.

Sugar Run.—Under construction, Sugar Run Junc. to Sugar Run Sta., 12 miles. Pres., W. T. Lewis, Coudersport. Ch. Engr., F. W. Dalrymple, Bradford.

Susquehanna.—Graded, end '91 track to Hulls, 13 miles. Pres., F. H. Goodyear; Ch. Engr., C. E. Botsford; both of Austin.

Western Maryland.—Surveyed, Porter's Sta. to York, 15 miles; Thomasville to Bowmansdale, 20 miles.

Total.—Under contract or construction, 223 miles. Surveyed or under survey, 258 miles. Projected, 110 miles.

Delaware.

Laurel & Roaring Point.—Projected, Laurel to Tyaskin, Md., 25 miles.

Odessa & Middletown.—Graded, Odessa to Middletown, 4.25 miles. Ch. Engr., Henry R. Campbell, 18 Broadway, New York City.

Total.—Under contract or construction, 4 miles. Projected, 10 miles.

Maryland.

Baltimore & Drum Point.—Partly graded, Baltimore to Drum Point, 82 miles.

Baltimore & Ohio.—Under construction, Knowles Sta. to Fairfax, Va., 25 miles; Aqueduct Bridge to District of Columbia line, 5 miles.

Confluence & Oakland.—Projected. Manor Lands to Oakland, 15 miles.

Deer Creek & Susquehanna.—Projected, Bel Air to Havre de Grace, 25 miles. Pres., Geo. M. Jewett, Glenville.

Washington & Chesapeake Beach.—Surveyed, Washington to Chesapeake Beach, 30 miles. Pres. Henan D. Wallbridge, Washington, D. C.

West Virginia Central & Pittsburg.—Surveyed, Cumberland to Hagerstown, 78 miles.

Total.—Under contract or construction, 47 miles. Surveyed or under survey, 115 miles. Projected, 55 miles.

NORTH CENTRAL.

Ohio.

Cleveland & Canton.—Projected, Justus to Portland, 40 miles.

Cleveland Belt.—Under contract, belt line at Cleveland, 7 miles.

Columbus & Westerville.—Surveyed, Columbus to Westerville, 12 miles. Pres., Moses H. Neil; Sec., G. W. Meeker, both of Columbus.

Findlay Belt.—Graded, belt line at Findlay, 10 miles. Chief Engr., Hosea Paul, Findlay.

Findlay, Ft. Wayne & Western.—Under construction, M. & E. Canal to Fort Wayne, Ind., 41 miles.

Lancaster & Hamden.—Partly graded, Laurelsville to Wellston, 37 miles. E. P. Buell & Co., Tarlton.

Pittsburg, Akron & Western.—Projected. Akron to Mogadore, 7 miles.

Pittsburg, Ohio Valley & Cincinnati. Tracklaying in progress, end of '91 track to Powhatan, 8 miles.

Port Clinton Short Line.—Located, Port Clinton to Fremont, 20 miles.

Salem & Washingtonville.—Tracklaying in progress, Salem to Washingtonville, 7 miles.

Toledo, Columbus & Cincinnati.—Surveyed, Ridgeway

to Columbus, 50.8 miles. Ch. Engr., J. C. Williams, Kenton.

Toledo, Walhounding Valley & Ohio.—Under construction, Coshocton to Loudonville, 46 miles.

Total.—Under contract or construction, 140 miles. Surveyed or under survey, 95 miles. Projected, 47 miles.

Michigan.

Chicago & West Michigan.—Track laid since Jan 1, 1892, end of '91 track to Petoskey, 2 miles. Under construction, Spencer Creek to Charlevoix, 37 miles.

Flint & Pere Marquette.—Surveyed, Delray to Detroit, 4.5 miles.

Frost.—Graded, Kenton to timber lands, 8.5 miles. Ch. Engr., F. A. Palmer, Kenton.

Grand Rapids & Indiana.—Track laid since Jan. 1, 1892, Marion to Bear Lake, 1.32 miles.

Iron Range & Huron Bay.—Graded, Huron Bay to Champion, 60 miles. Ch. Engr., Milo Davis, Detroit.

Manistee & Grand Rapids—Under construction, end of '91 track to Luther, 14.5 miles. Ch. Engr., E. W. Muenscher, Manistee.

Manistee & Northwestern.—Partly graded, Cedar River to Traverse City, 14.5 miles.

Manistique & Negaunee.—Surveyed, Negaunee to Manistique, 91 miles.

Milwaukee, Lake Shore & Western.—Under construction, 2.29 miles northwest of Little Falls northwest, 4.32 miles.

St. Joseph Valley.—Partly graded, Berrein Springs to Benton Harbor, 20 miles.

Total.—Under contract or construction, 162 miles. Surveyed or under survey, 95 miles.

Indiana.

Chicago, Indianapolis & Chattanooga Southern.—Located, Rockport to Mitchell, 70 miles. Pres., D. P. Irwin, Indianapolis. Ch. Engr., J. H. McCormick, Columbus.

Cleveland, Cincinnati, Chicago & St. Louis.—Located, Harrison, O., to Richmond, 39 miles.

Wabash.—Surveyed, Montpelier, O., to Hammond, Ind., 165 miles; 30 miles under construction.

Total.—Under contract or construction, 48 miles. Surveyed or under survey, 229 miles.

Illinois.

Belleville & St. Louis.—Partly graded, East St. Louis to Belleville, 13.5 miles.

Centralia & Chester.—Partly graded, Nashville to Centralia, 20 miles.

Chicago & Eastern Illinois.—Under survey, Shelbyville to Herrick, 15 miles.

Chicago & New Orleans.—Surveyed, Farina to Paducah, 130 miles. Ch. Engr., C. P. Moore, Chicago.

Chicago, Keokuk & Southwestern.—Projected, Havana to Keokuk, 68 miles.

Flora & Sailor Springs.—Surveyed, Flora to Sailor Springs, 10 miles. L. W. Barnes, Sailor Springs.

Illinois Central.—Graded, Kensington to Blue Island, 4 miles.

Indianapolis, Decatur & Western.—Surveyed, Decatur to Beardstown, 81 miles.

Jacksonville & Southeastern.—Projected, branch to Greenville, 4 miles.

La Salle & Bureau County—Located, zinc works to C., B. & Q. R. R., 6.75 miles. Ch. Engr., Isham Randolph, Chicago.

Pawnee.—Projected, Pawnee east, 9 miles. Sec., C. E. Clayton, Pawnee.

Quincy, Keokuk & Chicago.—Surveyed, Quincy to Madison, 50 miles. Ch. Engr., F. C. Horn, Chicago.

St. Louis, Chester & Grand Tower.—Under contract, East St. Louis to Grand Tower, 65 miles. Ch. Engr., Clinton F. Stephens, East St. Louis.

St. Louis, Collinsville & Carondelet Belt Line.—Surveyed, Madison to East Carondelet, 50 miles. Pres., A. M. Powell; Ch. Engr., S. A. Mitchell; both of Collinsville.

Totals.—Under contract or construction, 102 miles. Surveyed or under survey, 243 miles. Projected, 81 miles.

Wisconsin.

Bayfield Harbor & Great Western.—Located, Bayfield west 19 miles. Pres., Wm. F. Dalyrmple; Ch. Engr., D. F. Glover; both of Bayfield.

Kewaunee, Green Bay & Western.—Under contract, Luxemburg to Ahnapee, 13 miles.

Kickapoo Valley & Northern.—Under contract, Soldiers' Grove to Tomah, 85 miles. V. P., E. T. Kidd, Prairie du Chien.

Marinette & Western—Projected, Marinette to Abbottsford, 160 miles. Pres., Jesse Spaulding, Chicago, Ill. Sec., G. W. Henley, Marinette.

Milwaukee, Menominee Falls & Western.—Projected, Sussex to Beaver Dam, 40 miles.

West Superior Belt.—Under construction, belt railway at West Superior, 10 miles.

Total.—Under contract or construction, 114 miles. Surveyed or under survey, 19 miles. Projected, 344 miles.

SOUTH ATLANTIC.

Virginia.

Abingdon Coal & Iron.—Under construction, Abingdon to Damascus, 15 miles. Ch. Engr., J. C. Watson, Jr., Abingdon.

Baltimore & Ohio.—Under survey, Lexington to Glasgow, 15 miles.

Marion & Rye Valley.—Surveyed, Marion up Rye Valley, 7 miles.

Norfolk & Western.—Track laid, branch to terminus, 3 miles. Partly graded, Great Outburst to North Carolina line, 20 miles. Under construction, at Roanoke, Va., 6.75 miles; at Christiansburg, Va., 3 miles. Surveyed, branch up Little Tom Creek, 5 miles; Front Royal to Washington, 70 miles.

Roanoke, Fincastle & Clifton Forge.—Graded, Fincastle to Cloverdale, 12 miles. V. P., Chas. H. Vines, Fincastle.

Total.—Under contract or construction, 75 miles. Surveyed or under survey, 97 miles.

West Virginia.

Baltimore & Ohio.—Under construction, Morgantown to Uniontown, Pa., 33 miles.

Charleston, Clendennin & Southern.—Located, Charleston up Elk River, 20 miles. Pres., F. W. Abney, Charleston.

Hinton & New River.—Under survey, Hinton to mouth of East River, 33 miles. J. H. Miller, Hinton.

Norfolk & Western.—Under construction, Boissevain to Hallsville, 113.5 miles.

Ohio River.—Under construction, Twelve Pole River to Kenova, 4 miles.

Western Maryland.—Graded, Williamsport to Cherry Run, 4.3 miles.

West Virginia & Pittsburg.—Partly graded, Elk River to Gauley River, 32 miles; Newton to Pickens, 10 miles.

Wheeling & Connellsville.—Under survey, Wheeling to Connellsville, Pa., 60 miles. Pres., W. A. Lynch, Canton, O. Ch. Engr., Job Abbott, 150 Broadway, New York City.

Total.—Under contract or construction, 192 miles. Surveyed or under survey, 63 miles.

North Carolina.

Asheville & Weaverville Dummy.—Projected, Asheville to Weaverville, 8 miles. Pres., Jas. A. Reagan; Ch. Engr., Thad Coleman; both of Weaverville.

Atlantic Coast Line.—Track laid since Jan. 1, 1892, between Fayetteville and Rowland, 12.6 miles. Under construction, Greenville to Washington, 20 miles.

Brunswick, Western & Southern.—Surveyed Wilmington to Southport, 25 miles. Pres., Geo. L. Dunlap, Chicago.

Cape Fear & Yadkin Valley.—Graded, Mt. Airy to Virginia line, 7.5 miles.

Norfolk, Wilmington & Charleston.—Under survey, Charleston to Wilmington, 160 miles. Pres., J. C. McNaughton, Philadelphia, Pa.

Oxford & Coast Line.—Projected, Oxford to Wilson, 60 miles. Pres., W. F. Beasley, Oxford.

Richmond & Danville.—Projected, Mocksville to Mooresville, 38 miles; Winston to Danville, Va., 70 miles.

Roanoke & Southern.—Projected, Winston to Monroe, 85 miles.

Wilmington, Chadbourn & Conway.—Surveyed, Hub to Lumberton, 20 miles.

Wilmington, Onslow & East Carolina.—Surveyed, Jacksonville to Newbern, 30 miles.

Total.—Under contract or construction, 40 miles. Surveyed or under survey, 125 miles. Projected, 271 miles.

South Carolina.

Atlantic Coast Line.—Projected, south of Sumter to Augusta, 85 miles.

Carolina Southern.—Surveyed, Cheraw to Sumter, 65 miles.

Glenn Springs.—Projected, Delta to Glenn Springs, 10 miles. Pres., H. S. Simpson, Glenn Springs.

Jonesville & Lockhart Shoals.—Projected, Jonesville to Lockhart Shoals, 15 miles.

South Bound.—Projected, Columbia to Monroe, N. C., 75 miles.

Wilmington & Weldon.—Under construction, Latta to Clio, 18 miles.

Total.—Under contract or construction, 18 miles. Surveyed or under survey, 190 miles. Projected, 175.

Georgia.

Abbeville & Waycross.—Projected, Lulaville to Du Pont, 55 miles. Pres., J. D. Maynard, Abbeville.

Cartersville & Gainesville.—Projected, Cartersville to Gainesville, 73 miles. Ch. Engr., Parker N. Black, Atlanta.

Crawfish Springs & Round Mt.—Under construction, Chickamauga to Round Mt., 18 miles. Supt., S. F. Parrott, Chickamauga.

Douglas & McDonald.—Under construction, Douglas to McDonald, 18 miles.

Empire & Dublin.—Partly graded, Hawkinsville to Grovania, 13 miles.

Georgia, Carolina & Northern.—Under construction, end of '91 track to Atlanta, 23 miles.

Georgia, Tennessee & Illinois.—Surveyed, Tallapoosa to Stevenson, Ala., 125 miles. Ch. Engr., L. F. Bellinger, Tallapoosa.

Macon & Atlantic.—Location, Macon to mile post 58 58 miles; mile post 69 to Colleton, S. C., 114 miles.

Middle Georgia & Atlantic.—Graded, Machen to Covington, 25 miles. Partly graded, Newbern to Social Circle, 10 miles. Ch. Engr., Arthur Pew, Savannah.

Thomasville Southern.—Surveyed, Thomasville to Tallahassee, Fla., 35 miles.

Tuscaloosa Coal & Iron.—Projected, Tuscaloosa to coal fields, 20 miles.

Warsaw & Cumming.—Surveyed, Norcross to Cumming, 20 miles. Ch. Engr., Henry Collier, Warsaw.

Way Cross Air Line.—Surveyed, end of track northwest, 10 miles.

Total.—Under contract or construction, 107 miles Surveyed or under survey, 203 miles. Projected, 148 miles.

Florida.

Arcadia, Gulf Coast & Lakeland.—Under contract, Lakeland to Sarasota, 80 miles. Ch. Engr., H. B. Harvey, Punta Gorda.

Florida, Georgia & Western.—Partly graded, Lake Como to Aucilla River, 31 miles. Ch. Engr., F. P. Damon, Tallahassee.

Gainesville, Lacrosse & Lake Butler.—Projected, Gainesville to Lake Butler, 27 miles. G. W. Hyde, Gainesville.

Gainesville, Rocky Point & Micanopy.—Partly graded, Gainesville to Micanopy, 12 miles. Ch. Engr., P. F. Jenkins, Gainesville.

Halifax & Indian River.—Surveyed, Daytona to Titusville. 45.6 miles.

Lake Jessup, Indian River & Atlantic.—Surveyed, Lake Jessup to Coquina, 45 miles. J. S. Brown, Oviedo.

Palatka & Anclote.—Projected, Bronson to Luraville, 52 miles. Ch. Engr., Wm. E. Strong, Palatka.

Silver Springs, Ocala & Gulf—Under construction, Inverness, to Anclote, 52 miles.

South Florida.—Graded, 3 miles north of Pemberton Ferry to Inverness, 18 miles; Phosphoria to Bartow, 5 miles.

Starke & Sampson City.—Partly graded, Starke to Sampson City, 7 miles. Ch. Engr., R. F. Ensey, Starke.

Suwannee & Gulf.—Projected, Bronson to Luraville, 52 miles.

Total.—Under contract or construction, 200 miles. Surveyed or under survey, 111 miles. Projected, 131 miles.

(Continued on page 228.)

PERSONALS.

Mr. Henry C. Allen, Assoc. M. Am. Soc. C. E., has been reappointed City Engineer of Syracuse, N. Y.

Mr. Epes Randolph has been appointed Superintendent of the Ohio & Big Sandy R. R., with headquarters at Lexington, Ky.

Mr. Calvin A. Richards, a well known street railway man, Past President of the American Street Railway Association, died at Boston, Mass., Feb. 15.

Mr. Edgar Van Etten has been appointed Superintendent of the Buffalo division of the Lehigh Valley R. R., extending from Geneva to Buffalo, N. Y.

Mr. Lucius Tuttle, General Manager of the New York, New Haven & Hartford R. R., has been appointed Vice-President, vice Mr. E. M. Reed, deceased.

Mr. W. L. Stebbings, Assistant Engineer of Bridges, in charge of new bridges and repairs on the Chicago & Northwestern Ry., has resigned his position.

Mr. M. J. Carpenter, President of the Duluth & Iron Range R. R., has been elected President of the Chicago & Eastern Illinois R. R., vice Mr. G. W. Saul, resigned.

Mr. D. W. Seiler died in Harrisburg, Pa., on Feb. 28, aged 58 years. He was a civil engineer by profession, and was connected with the original surveys of the Philadelphia & Erie Railroad.

Mr. M. L. Hinman, Vice-President of the Brooks Locomotive Works, Dunkirk, N. Y., has been elected President, vice Mr. Edward Nichols, deceased, and Mr. R. J. Gross has been elected Vice-President. Mr. C. J. Carney is Superintendent.

Mr. W. A. Stevenson has been appointed Superintendent of the Ithaca division of the Lehigh Valley R. R., covering the lines of that system between Sayre, Pa., and Geneva, N. Y. Mr. Stevenson graduated at the mechanical engineering course of Lehigh University in 1888, and was for some time a member of the staff of Engineering News.

Mr. W. L. B. Jenney, a well known architect of Chicago, delivered a lecture on Feb. 25, before the students of the engineering department of the University of Illinois on "Tall Building Construction on Compressible Soils." This is the first of a series of ten lectures to be delivered during the present college year by civil and mechanical engineers and architects of reputation in their specialties.

Mr. A. B. Hill, Director Am. Soc. C. E., who has for some nine years past held the office of City Engineer of New Haven, Conn., after still longer service as Assistant City Engineer, and who made in both of these offices an honorable and unblemished record as a faithful officer, was on March 1 summarily removed from office, and Mr. C. R. Ingersoll appointed. No previous notice of any intended action of the kind was given, and the procedure was therefore thoroughly disreputable in form, as we believe it was unjustifiable in substance.

Mr. William Seaman, who died at Wilmington, Del., Feb. 26, at the age of 35, was a graduate of Swarthmore College and a civil engineer of some note. He served apprenticeships in the shops of the Wilmington and Phœnixville bridge works; was Resident Engineer of Construction of the Kinzua Viaduct on the New York, Lake Erie & Western R. R. and of the Cattaraugus Viaduct on the Rochester & Pittsburg R. R. and had been connected with the Norfolk R. R. and the Diamond State Iron Co. At the time of his death he was connected with the Lobdell Car Wheel Co., Wilmington, Del., and Vice President of the Crescent Horseshoe Co., Max Meadows, Va.

Mr. John F. Wallace, formerly Engineer of Construction on the Illinois Central R. R., has been appointed Chief Engineer, with headquarters at Chicago. He will have charge of all construction work, buildings, bridges, track, and all matters relating to maintenance of way. Master carpenters and bridge superintendents will report to and receive instructions from him. The office of engineer of construction is abolished. Mr. Wallace is about 40 years of age and has been engaged in railway construction, river improvements, and as engineer in charge on some of the large bridges over the western rivers for the past 20 years. He has more lately been associated with Mr. E. L. Corthell on bridges and river and harbor improvements.

Gen. George W. Cullum died in New York on Feb. 28, aged 83 years. Gen. Cullum was born in New York, and graduated from West Point, in the Corps of Engineers in 1833. He was first engaged upon fortifications and other public work at New London and Boston. In 1847-48 he published his "Memoirs on Military Bridges with India Rubber Pontoons," and from 1848 to 1855 he taught military engineering at West Point. After being engaged upon the harbor improvements of Charleston he was appointed aide-de-camp to the Commander-in-Chief of the Army on April 9, 1861. The same year he was made Chief Engineer of the department. He was chief of staff to Gen. Halleck

directed engineer operations on the Western rivers, and was Chief of Engineers at the siege of Corinth. From 1864 to 1866 he was Superintendent of the United States Military Academy. On March 13 he was breveted Colonel, Brigadier-General and Major-General for services during the war. He was a member of the Board for Improving the Defenses of New York. He was a member of the Board for Fortifications required for the National Defense, from 1866 until Jan. 13, 1874, when he was retired. Among the books which he published are: "A Biographical Register of the Officers and Graduates of the United States Military Academy from 1802-1850," a translation of Duparcq's "Elements of Military Art and History," "Systems of Military Bridges," a "Sketch of Major-General Richard Montgomery, of the Continental Army," "Campaigns and Engineers of the War of 1812," and a "Historical Sketch of the Fortification Defenses of Narragansett Bay Since the Founding in 1638 of the Colony of Rhode Island."

NEW PUBLICATIONS.

IRRIGATION CANALS AND OTHER IRRIGATION WORKS; Flow of Water in Irrigation Canals and Open and Closed Channels Generally. By P. J. Flynn, Mem. Am. Soc. C. E. Salt Lake City: Smythe, Britton & Poore. 8vo., double volume: Part I., pp. 385: 206 illustrations; tables. Part II., pp. 283; 69 tables; $8.00.

This work is an exhaustive treatise on irrigation construction and the designing of irrigation works, but is more especially devoted to irrigation canals. The whole field of irrigation publications, both in the way of exhaustive works and short papers and monographs, seems to have been searched by Mr. Flynn in the preparation of these volumes. All that the author has found of value in the writings of others, or rather so much of it as is necessary to establish beyond a doubt the best modern opinion and practice regarding each detail of construction and operation, is briefly presented in connection with the author's opinion on the same subject. American conditions and practices are kept continually in view, but the light of the experience of other countries is thrown upon the consideration of our own problems.

It is impossible to outline in detail the contents of the book, further than to say that each several part of irrigation works is discussed separately and thoroughly, 40 pages, for instance, being given to diversion weirs, 15 pages to falls, drops and checks in canals, and 16 pages to sluices, gates, movable dams or shutters. Illustrations and descriptions of works actually constructed in this and other countries accompany the discussions, and thus the work presents much matter of a very practical nature, besides its labor-saving features, noted further on.

The first part of the work consists of text and illustrations relating to the actual work of design, construction and maintenance of irrigation works, while the second part, as set forth below, has to do with the strictly mathematical problems involved in proportioning canals and open and closed channels for the work they are called upon to perform.

We have often had occasion to state that the number of practical works designed or even available for the use of American irrigation engineers is very limited. Mr. Flynn's work will do much to supply this deficiency.

Attention may be called to one section of this work, which all irrigation companies and managing officials should read, that is the section which discusses the maintenance and operation of irrigation canals. Defects in design and construction have been bad enough in connection with irrigation works, but improper management, lack of management, is perhaps to be equally deplored in this country. Mr. Flynn urges that more attention be given to this subject and states some facts regarding the practice of other countries.

Methods of irrigation are discussed at length, and perhaps this part of the work will be as helpful as any to those having the charge of completed works, and to the designing engineer as well, as there is very much for Americans to learn regarding the application of water to growing crops in such a manner as to secure the best effect with the least water. In most sections of our country where irrigation is practiced water is scarce compared with the irrigable area, and a higher duty of water must be secured, both by the judicious application of water and by the prevention of waste. Pipe irrigation, a great conserver of water, is, of course, discussed by Mr. Flynn.

The second volume is devoted to the discussion of the flow of water in irrigation canals and open and closed channels generally. Following the opinion of Maj. Allan Cunningham, R. E., an opinion deduced from most extended and elaborate experiments in India, the author adopts Kutter's formulæ as the best adapted to the flow of water in open channels of some size. For small open channels D'Arcy and Bazin's formulæ, and for cast-iron pipes, D'Arcy's formulæ, are generally accepted as being approximately correct. The author then proceeds in his endeavor to simplify and facilitate the application of these formulæ in the line of saving time and labor to the actively employed engineer. This simplification is presented in the form of numerous tables. In finding the mean velocity in open channels the proper selection of the coefficient of roughness (n) fixes in a great measure the accuracy of results obtained by the use of Kutter's formulæ. A long table is given for these coefficients as compiled from Kutter, Jackson and Hering, covering almost every conceivable contingency of surface. Tables are then given for channels with side slopes of 1 to 1, ½ to 1, 1½ to 1 and vertical or rectangular, with varying beds and depths. About 20 practical examples are worked out in all detail, selected with especial reference to irrigation practice. This part of the work includes 33 tables, many of them individually covering pages of the volume.

Mr. Flynn next discusses the various formulæ for mean velocities in pipes, sewers, conduits, etc. The writer believes that this list contains almost all the formulæ in use in different countries and in modern times, and is the most complete collection of formulæ on the flow of water in open and closed channels ever before gathered together in a single work. These various formulæ are compared and commented upon, and the author then explains the plan upon which he has constructed his tables for circular channels, and simplified the formulæ of Kutter and D'Arcy, and shows the utility of these tables as a labor saving device. The Kutter and D'Arcy formulæ are discussed and explained. Egg-shaped sewers are considered in this section of the work, and the tables are explained by examples, applying to pipes, sewers and conduits. It is impossible to enter into the detail of the 283 pages of text, with its 69 elaborately worked out tables in the space at command. But it is safe to say that Mr. Flynn has produced one of the most exhaustive and valuable treatises on the flow of water in open and closed channels that has ever yet appeared, and it will be correspondingly welcome to the hydraulic and irrigation engineer.

We are indebted to the author and the publishers for advance sheets of this work, which has been announced as to be ready for delivery on Feb. 25.

RETAINING WALLS FOR EARTH. Including the Theory of Earth Pressure as Developed from the Ellipse of Stress, with an Appendix presenting the Theory of Prof. Weyrauch. By Malverd A. Howe, C. E., Prof. C. E. Rose Polytech. Inst. 2d edition, revised and enlarged. New York: John Wiley & Sons. 12mo, pp. 136, 8 illustrations, 6 tables, $1.25.

In this edition the treatment of the subject has been at once extended and simplified as compared with the first edition. It is well that subjects of this nature should be thoroughly studied, but there are so many unknown and dubious elements about retaining walls that to the engineer pure and simple, mathematical treatises upon them are of little use, and we look with small patience upon works of this kind in which the giving of the conclusions reached "in intelligible language" at the back of the book or elsewhere is, to all appearances, deliberately avoided. The real basis of retaining wall practice is and ought to be experiment and experience, and not theory. So far as can be guessed from this little volume, theory, and theory only, determines it. As an exercise in mathematical gymnastics, therefore, the book may be excellent, but as a source of light in good retaining wall practice we should distrust it.

TEXT-BOOK ON RETAINING WALLS AND MASONRY DAMS. By Mansfield Merriman, Professor of Civil Engineering in Lehigh University.

John Wiley & Sons, New York, announce this work as in press, and we are told that it will be of a practical nature, well adapted to the use of engineers. The subject of the thrust of earth against retaining walls has always been one of vagueness and dispute, and no doubt many will be glad to know how Prof. Merriman deals with it.

GUIDE TO BALTIMORE, MD., with an Account of the Geology of Its Environs. American Institute of Mining Engineers, Baltimore meeting, February, 1892. Prepared by the local committee for the use of the Institute. Cloth, 8vo., pp. 139; illustrated, 3 maps.

This interesting book was prepared as a souvenir of the Baltimore meeting, a report of which was given last week. It contains much matter of interest in regard to the manufactures, industries and institutions of the city, and a lengthy treatise on the geology: "Geology of the Crystalline Rocks," by Prof. G. H. Williams, of Johns Hopkins University, and "Physiography of the Region and Geology of the Sedimentary Rocks," by G. N. H. Darton, U. S. Geological Survey. The book is accompanied by a map of the city, and two geological maps of the neighborhood prepared by the U. S. Geological Survey.

GEOLOGICAL SURVEY OF KENTUCKY. John R. Procter, Director. Report on the Occurrence of Petroleum, Natural Gas and Asphalt Rock in Western Kentucky. By Edward Orton. 8vo, pp. 233 and maps.

An interesting history of the development of the petroleum industry in this country, and the first uses of natural gas precedes a chapter on the origin of these products. The various theories accounting for their origin are given with discussions upon them. The geology of petroleum follows and the transportation and measurement of natural gas are briefly treated. The latter half of the work is devoted to the occurrence and production of petroleum in Western Kentucky.

CABLE AND ELECTRIC MOTIVE POWER ON STREET RAILWAYS COMPARED.—G. Leverich, C. E., Brooklyn, N. Y. 1891. Pamphlet, paper, 8vo., pp. 2.

This pamphlet has been written on account of the decision of the principal street railway companies of Brooklyn to substitute electric for horse traction on several lines, and is intended to show that the cable system would be more advantageous on these lines. The writer has been familiar for some years with the design and management of cable railways.

SOUTHERN AND SOUTHWESTERN RAILWAY CLUB.—Constitution and proceedings of the regular meeting at Atlanta, Ga., Jan. 21. Secy., S. A. Charpiot, Macon, Ga. Paper, 12mo., pp. 25.

The proceedings include discussions on "The Most Suitable Type of Hanging Inside Brake on Car Trucks," "Leaking Flues in Locomotive Boilers" and "Draft Timbers." The Richmond & Danville R. R. instructions to car inspectors are also given.

FUHRER DURCH DIE BAUMATERIAL—SAMMLUNG DES K. K. NATURHISTORISCHEN HOFMUSEUMS IN WEIN. Verfasst von Felix Karrer, mit einein Vorwerte des Herausgebers, Dr. Aristides Brezina, Director der Mineralogischen Abtheilung. Vienna. R. Lechner, pp. 355 and 40 phototypes of buildings, etc.

This is a guide to the Museum of Natural History in Vienna, covering about 7,000 exhibits from Europe, Asia and Africa, and North America. These exhibits include building material of all kinds, arranged in groups for location and geological position. The illustrations introduced are only used to show of what materials the buildings, etc., shown are constructed.

THE VENTILATION OF BUILDINGS, by Alfred R. Wolff, M. E. Second edition. 8vo. pamph., pp. 32. 315 Potter Building, New York. 25c.

A second edition of a useful pamphlet, treating of the proper methods of ventilating buildings, the quantity of air required under various conditions, the use of blowers, etc. The subject is plainly and clearly treated.

ROADMASTERS' ASSOCIATION OF AMERICA. Proceedings of the Ninth Annual Convention, held at Minneapolis, Minn., Sept. 8, 9, 10, 1891. Paper, 8vo, pp. 146, plates 2.

This is a complete report of the proceedings of the convention, with reports presented and discussion thereon, etc. A report of the meeting was given in our issue of Sept. 19, 1891.

IRRIGATION CONGRESS. Official Report of the Congress held at Salt Lake City, Sept. 15 to 17, 1891. 8vo. pamph. pp. 143.

The proceedings of the Congress of special interest to engineers have already been given in these columns.

ASSOCIATION OF EXECUTIVE HEALTH OFFICERS OF TORONTO. Report of the annual meeting at Trenton, Ont., Aug. 18 to 20, 1891. 8vo. pamph. pp. 141.

Papers in this report that may be mentioned are: "Public Water Supplies," by Willis Chipman, C. E., Toronto; "Subsoil Waters in their Sanitary and Engineering Relations," by C. H. Rust, C. E., Toronto; "A National System of Main Drainage as Applied to Toronto and Other Cities and Towns in Ontario," by H. B. Evans, M. D., Picton, Ont.; "Report of the Special Committee on Sewage Disposal," Mr. Chipman's paper on "Public Water Supplies" treats of the quality of water furnished in several Ontario towns and is accompanied by analyses. The Committee on Sewage Disposal recommends the separate system of sewerage wherever practicable, in order that the sewage may be utilized as a fertilizer. Irrigation is recommended.

WATER-WORKS REPORTS.—Annual reports have been received from works located in the cities and towns named below. The names given in connection with each locality are those of superintendents, unless otherwise specified. Matter of interest to our readers is abstracted from these reports and published from time to time under the heading "Notes From Recent Water Works Reports." Receipt of the following reports is acknowledged: Andover, Mass., J. E. Smith; Somerville, Mass., H. L. Eaton, City Engineer, N. Dennett; Springfield, Mass., J. C. Hancock; Taunton, Mass., G. F. Chace; Pawtucket, R. I., Edwin Darling; Providence, R. I., R. E. Smith, Commissioner Public Works; Johnstown, N. Y., J. J. Buchanan; Wilmington, Del., J. A. Bond, Chief Engineer; Washington, D. C., Geo. H. Elliott, Engineer in charge Washington Aqueduct; Louisville, Ky., Chas. Hermany; St. Louis Mo., M. L. Holman, Commissioner.

TRADE PUBLICATIONS.

VALVE CALENDAR for 1892. Lunkenheimer Brass Mfg. Co., Cincinnati, O.

This is a card calendar, with a representation of the company's improved "Handy" gate valve.

TELEGRAPHIC CODE. Carnegie, Phipps & Co. Pittsburg, Pa. Cloth, pp. 78.

This is a list of words of the company's telegraphic code for quotations, orders, dates, material, etc., with their explanation.

ROCK DRILLS, AIR COMPRESSORS and Mining, Tunneling and Quarrying Machinery. The Ingersoll-Sergeant Drill Co., New York City. Catalogue No. 8, Second Edition (B), 4to., pp. 222.

Although previous editions of this company's catalogues have seemed to be very nearly complete, the present one is much in advance of its predecessors and contains a great deal of technical information aside from its purely trade features. Extended extracts are made from Mr. Saunders' recent treatise on air compression, and there is some very practical information on the operation of rock drills, methods of quarrying, tunnel-driving, etc. The testimonials given contain many valuable records of the

cost of tunneling and rates of progress. The feature of the catalogue deserving most praise, however, is the fact that the prices and weights are given in connection with the machinery or supplies described, and that these prices are approximately the actual cost to the buyer. There is no such thing in the book, for instance, as list prices subject to a discount of 40 or 50%. Even on such standard lines of supplies as wrought iron pipe, the standard list prices are reduced to a proper basis. Of course the markets are subject to fluctuations, and the company especially requests its customers to write before ordering. At the same time, the prices given are intended to be accurate enough to enable engineers and contractors to use them in making estimates and without the trouble and delay of reckoning discounts. This will certainly be a great convenience, especially to the company's many customers who are located far distant from any point where regular market quotations may be had.

THE WESTINGHOUSE BRAKE.—Paper, 4to, pp. 48; plates, 29. London, 1889.
THE QUICK ACTING WESTINGHOUSE BRAKE.—General reference book. Paper, large 8vo, pp. 36; plates, 115. London, 1889.
THE WESTINGHOUSE AUTOMATIC BRAKE.—Described and illustrated. Cloth, 12mo, pp. 27; plates, 3. London, 1889.

These three books are the publications of the Westinghouse Brake Co., of London, England, and contain descriptions of the operation of the brake and its several details, with illustrations of parts, and plates showing the application of the brake to English locomotives and rolling stock. The third book mentioned is an instruction book for the use of employees, containing a description of the brake and general instructions for handling. The table of automatic brakes up to June 30, 1888, shows 7,096 engines and 52,370 cars fitted in Europe, India and Australia, or totals of 20,256 engines and 136,542 cars, including the United States. We publish a letter from this company in another column.

THE VACUUM AUTOMATIC BRAKE.—Cloth, 12mo.; pp. 16; plates, 3. Vacuum Brake Co., London.

This book contains a general description of the brake with instructions for handling. The company claims the miles run per fault during the first half of 1891 to be 120,329 miles for the vacuum as against 102,764 miles for the Westinghouse brake, but as these figures are made up from the Board of Trade returns they can hardly be considered as reliable. The company also sends us the "Report and Correspondence of the Government of India relating to Railway Brakes, Resulting in the Adoption of the Vacuum Automatic Brake for the Indian State Railways; and also Report of the Board Appointed by the Legislative Assembly in New South Wales, Recommending the Adoption of the Automatic Vacuum Brake," and the "Report of the Board Appointed to Inquire into the Efficiency of the Westinghouse and Vacuum Brakes for Goods Trains," in New South Wales. In another column we publish letters from the Vacuum and Westinghouse brake companies in England, with comments thereon.

SOCIETY PROCEEDINGS.

ENGINEERS' CLUB OF MINNEAPOLIS.—The following officers have been elected for the current year: President, Wm. A. Pike; Vice-President, W. W. Redfield; Librarian, A. B. Coe; Member of Board of Managers Association of Engineering Societies, Elbert Nexson; Secretary, F. W. Cappelen.

ENGINEERS' CLUB OF CINCINNATI.—At the February meeting, Mr. R. L. Read, Engineer of the Central Union Depot & Railway Co., gave a description of the plans of the proposed viaducts over the tracks of the Cleveland, Chicago, Cincinnati & St. Louis Ry., which are crossed at several places by streets on the same grade. The proposed system of viaducts eliminates these crossings and confines the travel to the overhead crossings, which are arranged to suit the travel in the best manner, and at the same time allow of a remodeling of the tracks used by the several railway companies entering the Union passenger station, thus greatly facilitating the train service within the limits affected by the proposed scheme.

NATIONAL ELECTRIC LIGHT ASSOCIATION.—The annual meeting was held at Buffalo, N. Y., Feb. 23, 24 and 25. Reports were presented by committees on "Safe Wiring," "Underground Conduits and Wires," and "The World's Columbian Exposition." Papers were read on "The Relation of Size and Efficiency in Transformers," M. Stillwell; "The Construction, Safety and Operation of Switchboards," M. C. Sullivan; "Franchises for Quasi-Public Corporations," A. R. Foote; "Electric Lighting from a Financial Standpoint," Erastus Wiman; "How to Fire a Steam Engine," R. Hammond; "Overhead Construction," E. F. Peck; "Operation of High Tension Currents Underground," E. A. Leslie; "The Underground Construction of the Buffalo Ry. Co.," J. B. Craven; "The Allied Powers," D. Ashworth; "From the Tannery to the Dynamo," C. A. Schieren; "Alternate Current Motors," Wm. Stanley, Jr.

The following officers were elected: President, James I. Ayer, St. Louis, Mo.; First Vice-President, E. A. Armstrong, Camden, N. J.; Second Vice-President, C. H. Wilmerding, Chicago, Ill.; Secretary, George F. Porter, New York. The next meeting will be held in St. Louis, Mo., February, 1893.

WESTERN RAILWAY CLUB.—At the meeting on Feb. 16 the paper by D. L. Barnes on "Recent Progress in Freight Car Construction" (Eng. News, Jan. 30, 1892) was discussed. The composite bolster of wood and metal, recommended by Mr. Barnes, was criticised by Mr. Gibbs, who thought that the wood and iron would not work well together. Mr. Forsyth, stated, however, that bolsters of this type in use on the Chicago, Burlington & Quincy were doing excellent service, and each part of the bolster seemed to take about its proper share of the load. Mr. Schroyer preferred the composite bolster to the trussed bolster. He did not consider that any trussing which could be put on a bolster could be of any service unless the rods were put under an initial tension sufficient to arch the bolster. He had made tests which had showed that the wooden bolster with an iron plate would sustain a load of 84,000 lbs. without excessive deflection. Shrinkage of timber will loosen the plates to some extent, but all parts soon get their bearings. The trussed wooden bolster had proved expensive and troublesome to maintain. It is an error to make the plate as deep as the timber in a composite bolster. On the Chicago & Northwestern the standard bolster has a plate 6 by ⅜ ins. and a timber 7¾ ins. deep.

About 40 Harvey steel cars on the Chicago, Milwaukee & St. Paul, and 10 on the Chicago & Grand Trunk were reported to be giving excellent service with no reports of breakages. Several Fox pressed steel trucks were also reported as on trial and giving good results.

The question of omitting the labor charge for changing brake shoes was discussed, and it was generally considered advisable, provided all roads would unite in it. After some discussion, Messrs. Barr, Dowling and Schroyer were appointed a committee to report at the next meeting on desirable changes to Rule 8 of the Rules of Interchange, which covers charges for repairs to foreign cars.

A paper was then read by Mr. Wm. Forsyth on "The Strength of Car Couplers of the M. C.B. type." We reprint it in another column.

ENGINEERS' CLUB OF PHILADELPHIA.—Meeting, Feb. 20, Past President Henry G. Morris in the chair. About 40 members present. After some discussion on the advantages of a large building for the joint use of the various engineering and technical societies of Philadelphia, it was resolved, on motion of Mr. Carl Hering, that a committee of five be appointed to confer with other societies on the advisability of erecting a large building for their joint use.

Mr. A. Saunders Morris read a paper on Limitations of Electric Power Transmission, which was discussed by Mr. Carl Hering, and Mr. Morris replied to a number of questions raised. In reference to M. Bazin's weir experiments, which was presented in abstract only, a letter was read from Mr. Robert A. Cummings, expressing his appreciation of the labors of the translators in bringing these experiments before a larger audience of engineers. He also made some inquiries as to the effect of different materials used in the weir and as to the effect of air pressure upon the form of the "nappe." A letter from Mr. Trautwine, in reply to these inquiries, was read, stating that, so far as he knew, M. Bazin had not yet extended his experiments to the question of the effect of different materials used in the construction of a weir, his object having been rather to remove as far as possible all causes of friction, in order that his experiments might be carried on under conditions as near to theoretical perfection as might be. As to the second point, unless special precautions are taken, the falling sheet of water carries down with it part of the limited supply of air between it and the face of the weir, thus producing a partial vacuum there, as is evidenced, first, by the gradual approach of the sheet toward the weir, and, second, by the accumulation of a body of water between the two to a level above that of the downstream surface. If the falling sheet of water, or "nappe," be then broken, whether intentionally or by the excess of air pressure on its face, and the air is thus admitted behind the nappe, the latter immediately springs out to its normal position, but the process is repeated if the supply of air behind the nappe is again cut off. To avoid this complication, M. Bazin took special care, in his experiments, to provide free access of air between the nappe and the weir, as explained in the Club Proceedings, Vol. VII., No. 5, January, 1890. Owing to the lateness of the hour, Capt. Leach's paper on Mississippi River improvement was again deferred.

Wilfred Lewis, Secretary pro tem.

AMERICAN SOCIETY OF CIVIL ENGINEERS.—The regular meeting was held March 2; the President, Mr. Mendes Cohen, in the chair. The Secretary read a paper by Mr. E. Kuichling on "The Loss of Head Resulting from the Passage of Water through a 24-in. Stop Valve." Very careful observations with mercury gages showed a loss of head of from 0.139 ft. of water with two-thirds of the full opening, 2.844 ft. with one-third, and 9.281 ft. with 13-72 of full opening. There was much oscillation of the mercury in the gage tubes, especially with the smaller openings. Mr. Herschel, in discussion, referred to this oscillation, and stated that in his opinion all flowing water was pulsating, causing a constant change in the flow. A paper by Mr. Lewis King man on "Electric Lighting at Topeka, Kan.," was presented but not read. Discussion was then resumed on the paper by Mr. Wm. Starling on "The Dikes of Holland," which had been read at the previous meeting. Mr. Starling had spoken approvingly of the use of clay for embankments, but Mr. Herschel and Mr. Worthen spoke strongly against this material, largely on account of its liability to wash away, and recommended clean gravel and sand as more reliable. Mr. Cartright thought clay an excellent material if only protected from the wash of water. Mr. Brush thought clay puddle an excellent material in dams, etc. Mr. Croes referred to the Ridgewood reservoir, at Brooklyn, N. Y., which was originally built with a carefully made puddle face; on water being let into the reservoir, the wall slumped and slid down, and the entire reservoir had to be faced with a mortar wall. He approved of a clay and gravel puddle wall in the heart of a bank where protected from the washing action of water. Mr. North and Mr. Cohen referred to railway banks of wet clay which had given trouble by sliding. Mr. Bogart referred to the varying character of materials generally classed as gravel. Mr. J. F. Crowell stated that he had found good results in covering a clay embankment with sand to make the bank watertight, and he thought that in many cases a mixture of clay and gravel or clay and sand might produce desired results which could not be obtained by the use of either material alone.

The following candidates were declared elected:

Members: David M. Andrews, U. S. Asst. Engineer on Coosa River Improvement, Lock Three, Ala.; James Duane, Engineer in charge of laying Croton pipe, New York, N. Y.; Charles B. Dudley, Chemist to the Pennsylvania R. R., Altoona, Pa.; Robert Gayol, City Engineer, City of Mexico; Justus H. Grant, contractor, Rochester, N. Y.; H. C. Lowrie, Board of Public Works, Denver, Col.; George F. Swain, Professor of Civil Engineering, Massachusetts Institute of Technology, and Engineer to Massachusetts Railroad Commission, Boston, Mass.; S. E. Tinkham, Assistant City Engineer, Boston, Mass.

Associate Members: Albert Carr, Division Engineer Broadway Cable Railway, New York, N. Y.; L. W Goddard, Assistant Engineer, River and Harbor Improvements, Grand Rapids, Mich.; Henry H. Kerr, City Engineer, Fort Worth, Tex.

COMING TECHNICAL MEETINGS.

ENGINEERS' CLUB OF PHILADELPHIA.
March 5. 1123 Girard St. Secy., J. C. Trautwine.
SWEDISH ENGINEERS' CLUB.
March 5. Secy., P. Valentine. At 231 Union St., Brooklyn, and 646 North 10th St., Philadelphia.
NORTHWEST RAILROAD CLUB.
March 5. Union Station, St. Paul.
CIVIL ENGINEERS' SOCIETY OF ST. PAUL.
March 7. Secy., C. L. Annan.
DENVER SOCIETY OF CIVIL ENGINEERS.
March 8. Secy., Geo. H. Angell, Jacobson Block.
ATLANTA SOCIETY OF CIVIL ENGINEERS.
March 8. Secy., Parker N. Black, Capitol Block.
CIVIL ENGINEERS' CLUB OF CLEVELAND.
March 8. Secy., A. H. Porter, 50 Euclid Ave.
NORTHWESTERN SOCIETY OF ENGINEERS.
March 8. Occident'l Block, Seattle. Secy., E. H. Warner.
NEW ENGLAND WATER-WORKS ASSOCIATION.
March 9. Boston, Mass. Secy., R. C. P. Coggeshall, New Bedford, Mass.
NEW ENGLAND RAILROAD CLUB.
March 9. United States Hotel, Boston. Secy., F. M. Curtis.
ENGINEERING ASSOCIATION OF THE SOUTHWEST.
March 10. Secy., O. H. Landreth, Nashville, Tenn.
ENGINEERS' AND ARCHITECTS' CLUB OF LOUISVILLE.
March 10. Secy., Edward Mead, Norton Building.
NORTHWESTERN TRACK AND BRIDGE ASSOCIATION.
March 11. Union Station, St. Paul.
TECHNICAL SOCIETY OF NEW YORK.
March 12. 194 Third Ave. Sec., H. Schreiter.
ASSOCIATION OF ENGINEERS OF VIRGINIA.
March 12. At Roanoke. Secy., J. E. Schick, Roanoke, Va.
ENGINEERS' CLUB OF KANSAS CITY.
March 14. Baird Building. Secy., H. Goldmark.
WISCONSIN POLYTECHNIC CO.
March 14. Secy., E. F. Neukom, Milwaukee, Wis.
WESTERN RAILWAY CLUB.
March 15. Rookery Building, Chicago. Secy., W. H. Marshall.
ENGINEERS' SOCIETY OF WESTERN PENNSYLVANIA.
March 15. Secy., J. H. Harlow, Pittsburg, Pa.
BOSTON SOCIETY OF CIVIL ENGINEERS.
March 16. Secy., S. E. Tinkham, City Hall.
ENGINEERS' CLUB OF ST. LOUIS.
March 16. Secy., Arthur Thacher, Odd Fellows' Building.
AMERICAN SOCIETY OF CIVIL ENGINEERS.
March 16. Secy., F. Collingwood, 127 East 23d St., New York.
CANADIAN SOCIETY OF CIVIL ENGINEERS.
March 17. Secy., C. H. McLeod, Montreal, P. Q.
ENGINEERS' CLUB OF CINCINNATI.
March 17. Secy., J. F. Wilson.
SCANDINAVIAN ENGINEERING SOCIETY OF CHICAGO.
March 17. Secy., T. G. Phifield, 115 Adams St.
SOUTHERN AND SOUTHWESTERN RAILWAY CLUB.
March 17. At Atlanta, Ga. Secy., F. A. Charlot, Macon, Ga.
NEW YORK RAILROAD CLUB.
March 17. Secy., H. G. Prout, 73 Broadway.
MONTANA SOCIETY OF CIVIL ENGINEERS.
March 19. Secy., F. D. Jones, Helena.
CENTRAL RAILWAY CLUB OF BUFFALO.
March 24. Secy., Jas. Macbeth.
ASSOCIATION OF CIVIL ENGINEERS OF DALLAS.
April 1. Secy., E. K. Smoot, 803 Commerce St.
TECHNICAL SOCIETY OF THE PACIFIC COAST.
April 1. Secy., O. von Geldern, 319 Market St., San Francisco.
WESTERN SOCIETY OF ENGINEERS.
April 6. Secy., J. W. Weston, 380 La Salle St., Chicago.
ENGINEERS' CLUB OF MINNEAPOLIS.
April 7. Public Library Bldg. Secy., F. W. Cappelen.
AMERICAN SOCIETY OF MECHANICAL ENGINEERS.
May 16 to 20. San Francisco, Cal. Secy., F. R. Hutton, 12 W. 31st St., New York.

ENGINEERING NEWS
AND
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VOL. XXVII. SATURDAY, MARCH 5, 1892.

D. McN. STAUFFER, A. M. WELLINGTON.....EDITORS
CHAS. W. BAKER, E. E. R. TRATMAN, M. N. BAKER, F. P. BURT, } ASSOCIATE EDITORS
GEO. H. FROST.....BUSINESS MANAGER

SUBSCRIPTION RATES: one year, $5.00; 6 months $2.50; 4 months, $2.00; single copies, 15 cents. To all foreign countries in the Postal Union, add $2.08 to above prices for postage. Subscribers can have the mailing address of their paper changed as often as they desire. Send both the old and the new addresses. No club rates allowed.

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ADVERTISING RATES, 20 cents per line agate measure. Schedule sent on request. Changes of advertisements must be in hand on Tuesday afternoon: new advertisements, Wednesday afternoon; transient advertisements, not later than Thursday noon. The last pages go to press early on Friday, and we shall be obliged if subscribers who fail to receive their papers promptly will notify us without delay.

Mr. Chauncey M. Depew, in arguing before a committee of the New York Legislature on the proposed raising of the N. Y. Central bridge over the Harlem River, says, that while his company is prepared to spend $3,000,000 in obeying the demands of the United States government, "I take it that for the city of New York, which has water on three sides, to induce the general government to cut the city in two in order to have water on all sides, is about the most monstrous piece of folly I know of."

We fully agree with Mr. Depew, and though it is too late to enter available protest against the proposed "improvement" of the Harlem River in the face of the present government expenditure in that direction, we feel safe in predicting that the future New York will spend other millions in undoing the folly of this generation. New York must seek an outlet northward for its rapidly swelling population, and this "improvement" can only retard that natural growth until ruling conditions compel what common wisdom now dictates. While the great cities of the world were almost without exception founded upon waterways, as a natural result of early methods of traffic, we are not aware that any other city, equal in importance to New York, has deliberately cut itself in two by the construction of a ship canal at this late date. Waterways in cities mean costly bridges, an eternal conflict between shipping and railways, a congestion of building construction and a permanent inconvenience to traffic of all kinds. In spite of the array of adroitly handled commercial statistics presented by those interested in possible but improbable docks along the Harlem, there seems small chance of any wide benefit to the citizens of New York, and we can see in the proposed waterway only another case of the sacrifice of the vital general growth of New York city to the demands of a comparatively very limited outside commerce and the views of a very few holders of adjoining real estate.

Since writing the above, a project has been presented to the Sinking Fund Commissioners for a covered waterway, 60 ft. wide, and 70 ft. high, built on the westerly side of the Harlem River, from Third Ave. to Eighth Ave., and for the filling in of the river between. There is doubtless something to be said for this plan as a means for transferring canal boats from the North to the East River. But in presenting this plan, its promoters point out the absurdity of calling the improvement now under way a "ship canal," with its 15 ft of water and headroom limited by the present High Bridge. It is also shown that whereas, in obtaining appropriations for this ship canal, it was stated that the commerce of the Harlem amounted to 3,384,486 tons annually, those interested omitted to mention that 1,407,882 tons of this "river commerce," or nearly one-half, was handled at the docks of the New York & New Haven R. R. Co. below Second Ave., where a ship canal would in nowise affect it. Of the balance the New York & Northern R. R. Co. handled 246,402 tons, only a little further up the Harlem. The interest of New York City in extending its bounds northward is evidently worth many times the present and future commerce of this waterway, and it would seem best to eliminate the transit question altogether, put in a sewer and connect New York with its annexed districts by solid land.

The New York Air Brake Co. has lost no time in repeating the tests on the Lehigh Valley R. R., which we described last week, and which showed their triple-valve to be defective in point of release. Without any previous announcement they have made a second series of tests, reported in another column, in which the release seems to have been secured without difficulty. The failure to release properly in previous tests seems to have been due to leakage past the triple-valve and emergency pistons, and the change made, we understand, was simply the adoption of improved methods of manufacture which practically obviated this leakage. We are informed that the new valves were the same in every respect as the triples previously tested at Burlington and the week previous on the Lehigh Valley, except that the piston rings were more accurately ground. No change was made in the design nor were heavier springs used.

While the tests were made under direction of Lehigh Valley officials and have their approval, it is to be regretted that no representative of the Westinghouse Company was present at these tests. Saying nothing of any claims which it may make as to its right to be represented as an interested competitor, who had taken part in the joint tests a week previous of which these were really a continuation, it is undeniably true that those connected with the Westinghouse Company have a practical knowledge of triple-valve construction and operation such as few railway men can claim, and their assistance and counsel in a test of this sort are an aid in getting at exact facts, which should not be discarded.

At the same time the conduct of tests of this sort and the final interpretation of their results must be made by the railway mechanical officers, and upon them also devolves the chief labor of preparing a satisfactory standard system of tests by which the qualities of any new kind of brake may be tested. The various tests made during the past month have shown the difficulties in formulating satisfactory standard tests, but have not shed much light on how these difficulties are to be overcome. It is worth while here, however, to call attention to a fact which railway operating officers must appreciate, that the only wholly satisfactory test of brakes is one made with triple-valves which have seen service and plenty of it, and thus have gathered such amount of grit, oil, gum, etc., as long service necessitates.

It is among the most important of the facts which developed in the Burlington tests on Feb. 5, that the Westinghouse brake, with triple-valves which had been in service for two years and were used without cleaning or repairs, showed an efficiency in making emergency stops which was practically as good as that of the new valves, in condition as nearly perfect as possible. However, as the old valves had been used on palace stock cars and on a road where brakes probably receive better care than on the average railway, it should not be concluded from the results of this test that the proper care of brakes is an unimportant matter.

The release tests which have recently been made have shown the need of some more definite standard of excellence in this respect than has yet been suggested. Restore the train-pipe pressure slowly enough and there will be leakage enough with any triple-valve to prevent a release. On the other hand if the train-pipe pressure is raised rapidly enough, even defective brakes are bound to come off. What is wanted is some fixed rate for the admission of air in release tests, which shall be applied to all brakes offered for service.

The importance of having brakes which will keep in good order when subjected to the vicissitudes of ordinary use is well shown by the Lehigh Valley tests made to see how many cut-out cars the quick-action would jump. With the Westinghouse triple-valve, the quick-action passed four cut-out cars. With the New York triple-valve, the quick-action passed two cut-out cars in the first tests and three in the later tests. Everyone knows how common it is for freight cars with brakes which cause trouble by sticking to have the brake cut out, and it needs only a few such cars bunched together at the middle of a train to stop the quick-action and give only a service application on the rear of the train. This would be very likely to cause terrific shocks at the rear end of a long train. The new rules for the care of air brakes which are now under consideration will doubtless severely discountenance the running of cars with brakes cut out for any longer distance than is absolutely necessary.

THE PROSPECTS OF RAILWAY CONSTRUCTION IN 1892.

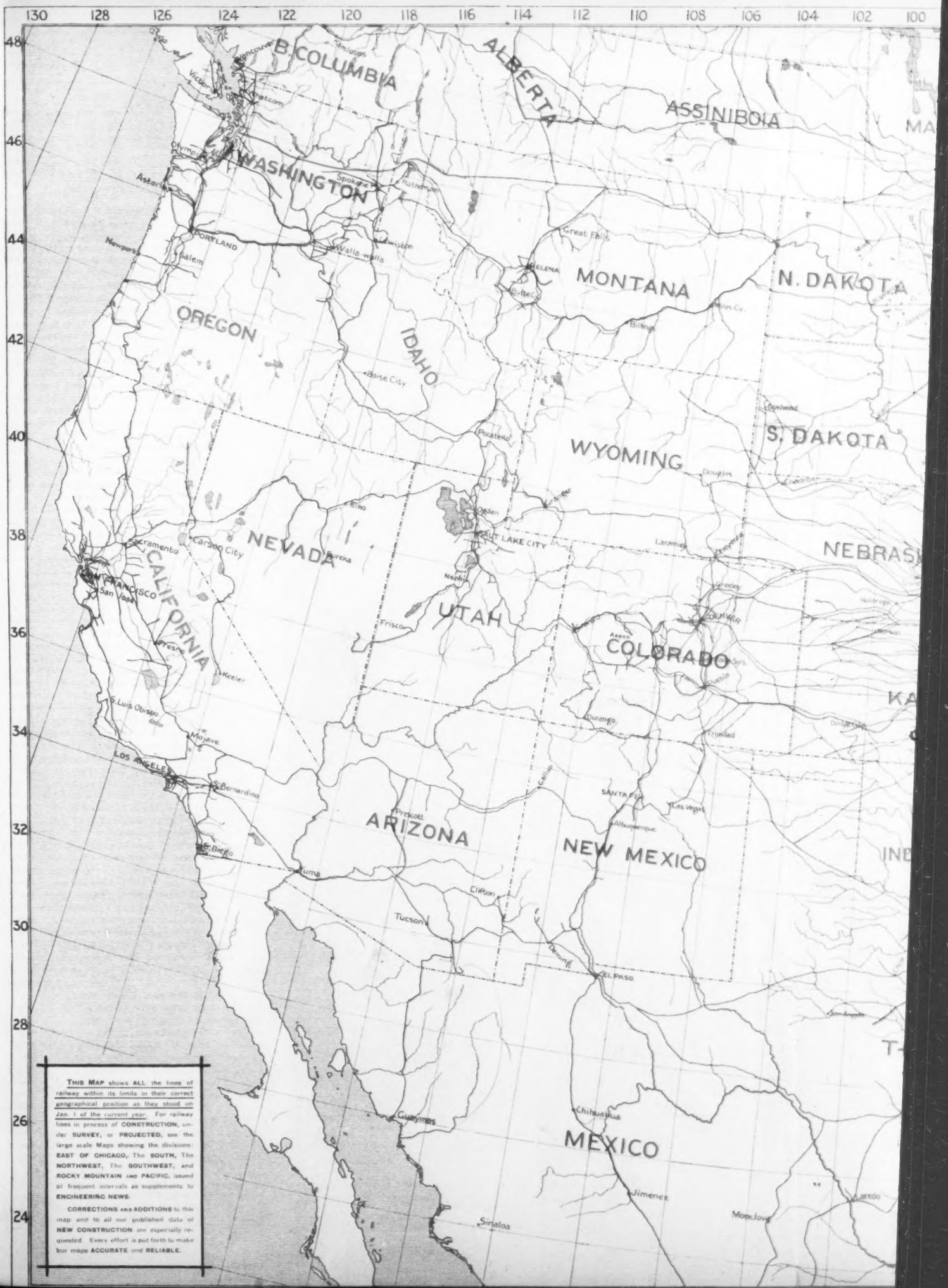
The statistics of the prospective railway construction for 1892, which we present with this issue, show upon their face a decided decrease in the activity of work from similar figures published one year ago, a decrease, however, which for several reasons should not lead to too dismal views as to the prospects for the year. According to the summary of our detailed list there are now 4,274 miles of railway partly completed or under contract, 4,630 miles upon which the surveys have been completed or are in progress, and 2,371 miles upon which no surveying has been reported, but which appear to have a fair prospect of being placed under contract during the year. Comparing these totals with those published in connection with the last preceding issue of this map we have the following results at the two dates named:

	In process of construction.	Surveyed or under survey.	Projects of some promise.
Feb. 28, 1891.....	7,132	7,787	3,891
March 5, 1892.....	4,274	4,630	2,371
Decrease, miles....	2,858	3,157	1,520
Dec. per cent.....	40%	40.5%	39%

It will be seen from the table that the mileage of prospective railway construction is nearly 40% less at the present date than it was a year ago. This statement, however, is not really so unsatisfactory as it appears on its face. In seeking to account for this somewhat unfavorable outlook there are several factors to be considered. In the first place the comparison is made with a year following directly the year of heaviest construction since 1887, when a large number of lines, started under the favoring conditions of that year, were being vigorously pushed by their promoters. The effects of the financial stringency in the autumn of 1890 were not then fully evident, and these lines were included in our figures with the qualifying statement that their probable construction would depend largely upon the condition of the money market. On the other hand the present totals follow a year showing the smallest mileage of railway built since 1885, and consequently partake of the unfavorable conditions for the inception and active promotion of new enterprises attendant upon such a decrease in activity. Again, many of the larger systems, especially in the Middle and Western States, which have largely held aloof from new construction for the past few years, are projecting or have under way extensive improvements in permanent way and equipment, which are absorbing a large amount of capital that would otherwise be largely used in the construction of new lines. Against these influences unfavorable to the construction of a large mileage of new road we find the favoring influences of large crops, easier money, and a generally improved outlook for all industries. These augur well for the expenditure of capital in railway work. It seems probable, however, that a much larger proportion than for some years past may be expended in improvements, as before stated, but it will be a remarkable change from the present outlook if any more new track should be laid in 1892 than was laid in 1891, or even so much. In order to permit of a more detailed comparison of the prospective work of the two years we show in Table I. the mileage under construction and under survey in each group of states at the dates of Feb. 28, 1891, and March 5, 1892; together with the increase or decrease per cent.

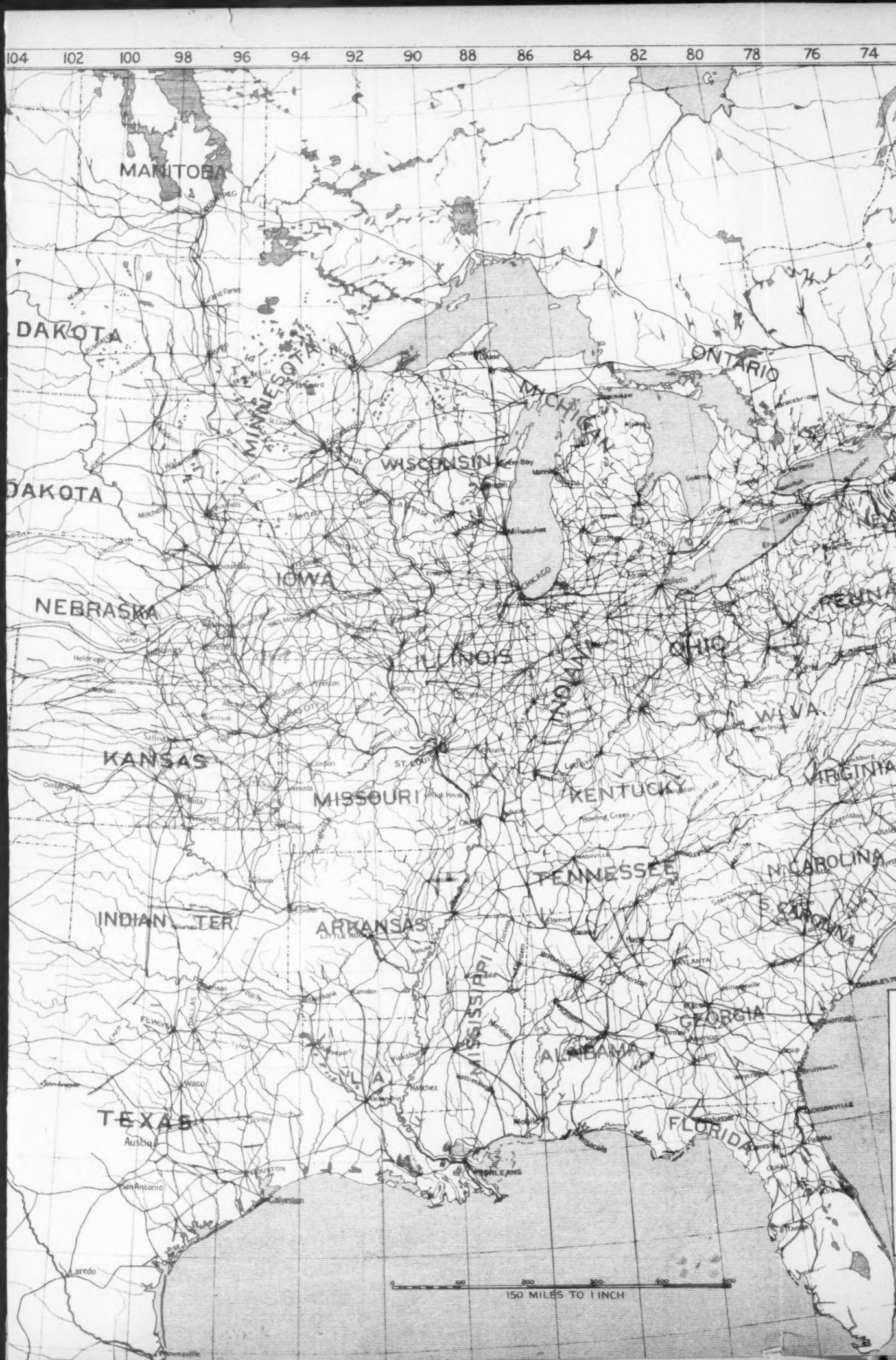
Table I.

Table Showing by Groups of States the Comparative Mileage Under Construction and Survey, Feb. 28, 1891 and March 5, 1892:



THIS MAP shows **ALL** the lines of railway within its limits in their correct geographical position as they stood on Jan. 1 of the current year. For railway lines in process of **CONSTRUCTION**, under **SURVEY**, or **PROJECTED**, see the large scale Maps showing the divisions: **EAST OF CHICAGO**, The **SOUTH**, The **NORTHWEST**, The **SOUTHWEST**, and **ROCKY MOUNTAIN AND PACIFIC**, issued at frequent intervals as supplements to **ENGINEERING NEWS**.

CORRECTIONS AND ADDITIONS to this map and to all our published data of **NEW CONSTRUCTION** are especially requested. Every effort is put forth to make our maps **ACCURATE** and **RELIABLE**.


104
102
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MANITOBA
WINNIPEG
DAKOTA
DAKOTA
MINNESOTA
ONTARIO
MICHIGAN
WISCONSIN
Milwaukee
CHICAGO
IOWA
NEBRASKA
ILLINOIS
OHIO
W.VA.
KANSAS
MISSOURI
ST. LOUIS
KENTUCKY
VIRGINIA
TENNESSEE
N. CAROLINA
S. CAROLINA
INDIAN TER.
ARKANSAS
LITTLE ROCK
ATLANTA
GEORGIA
ALABAMA
MISSISSIPPI
LOUISIANA
TEXAS
FLORIDA
Austin
HOUSTON
NEW ORLEANS
San Antonio
Galveston
Laredo
Brownsville
150 MILES TO 1 INCH

ENGINEERING NEWS SERIES OF MAPS: No. 41.

UNITED STATES.

RAILWAY CONSTRUCTION IN 1892.

LINES OF RAILWAY WHICH HAVE SOME PROSPECT OF BEING COMPLETED OR PLACED UNDER CONSTRUCTION OR CONTRACT BEFORE JAN. 1, 1893.

For details of progress on the various enterprises, with principal projectors or officers, see accompanying list.

Group of states	In proc. of constr. 1891.	1892.	Inc. or dec. per cent.	Sur. or under sur. 1891.	1892.	Inc. or dec. per cent.
New England..	50	67	+123.3	520	292	—43.8
Middle.....	703	529	—24.8	965	420	—56.5
No. Central....	447	566	+26.6	618	684	—6.1
So. Atlantic....	1,636	632	—61.36	850	798	+5.5
So. Central....	978	565	—45.1	1 397	430	—69 2
Southwestern..	795	428	—46.1	1,145	920	—36.3
Northwestern..	1,405	509	- 63.7	593	313	—47.2
Pacific.....	1,138	977	—14.1	1,399	773	—44.8
Total, U. S.	7,132	4,274	—40.0	7,787	4,630	—40.5

From this table it is seen that, with the exception of the New England and North Central groups of states, each group shows a decrease from last year's figures in the mileage upon which work is under way, varying from 14.1% to 63.7%. In the mileage in process of survey all groups except the North Central exhibit a decrease. The South Atlantic group has the largest mileage under way, including all classes of work—construction, surveys, and projects—this year as it did last. Grading has been begun upon less than one-third of this, however, while a year ago over one-half of the projected mileage was under contract or construction. An examination of our detailed list will also show that active work is in progress upon only a small proportion of the 632 miles considered as in process of construction. The same is true of the South Central group which, with the South Atlantic group, comprises the eleven states generally known as the Southern States. Moreover, the prospects of work being soon resumed on many of the lines upon which it is now discontinued are not favorable. The financial disturbances of the past year were very heavily felt in this section, as the abundant receiverships granted will attest. In addition, the earnings of the Southern railways during the past twelve months have been only moderately favorable owing to the declining price of cotton and the low price of iron, even including several of the larger systems which show exceptionally favorable results from operations. The earnings thus far this year are still less favorable. From the present outlook it seems probable that there will be less railway construction in this section during 1892 than for some years heretofore. The Pacific group has the largest mileage under construction and stands second in the total mileage of all kinds under way. The Middle, North Central and Northwestern groups run quite evenly, having 529 miles, 566 miles and 509 miles under construction, respectively.

Considering the work more in detail we present in table 2 a summary of the mileage under way in the various states and groups of states.

In studying this table as well as the detailed list it is to be borne in mind that many of the enterprises included therein which now seem to promise well will fail entirely, or be compelled to delay construction. On the other hand many enterprises, which are not yet sufficiently advanced to be included in our list, may be taken up and pushed to completion. It will be seen that Washington heads the list with 887 miles and is followed next by Pennsylvania and Alabama with 591 miles and 508 miles respectively. Among the other states having a large mileage under way are Georgia, Florida and North Carolina, in the South Atlantic Group, with 458, 442, and 436 miles, respectively; Louisiana and Tennessee, in the South Central, with 499 miles and 477 miles, respectively; Illinois and Wisconsin, in the North Central, with 426 miles and 477 miles, respectively, and Texas, in the Southwestern, with 487 miles. These totals include all classes of work—construction, surveys and projects.

An examination of the map will show that the character of the prospective work shown is the same as that of the three preceding years; that is, it consists with few exceptions of short branches and connections to develop local traffic, and shows almost none of that competitive character which distinguished the construction of 1886, 1887 and 1888. A great majority of these lines are projected in localities needing better railway facilities, and have a legitimate right to eventual success.

In the New England and Middle States the work consists almost entirely of lines under 50 miles in length. The only long lines under way are the Bangor & Aroostook R. R. in the northern part of Maine, and the Adirondack & St. Lawrence R. R. in New York. This latter line is by far the longest and most important of any under way in the two groups named. It connects with the New York Central & Hudson River R. R. at Herkimer, N. Y., and runs

Table 2.

Table showing by States and Groups of States the mileage of railway under construction and survey, and projected on March 5, 1892:

States.	In process of construction.	Surveyed or under survey.	Projected.
New England.			
Me.....	20	171	..
N. H.....	21	53	..
Vt.....	..	18	..
Mass.....	26	22	15
Conn.....	..	28	
Total.....	67	292	15
Middle.			
N. Y.....	198	25	..
N. J.....	7	22	..
Pa.....	223	258	110
Del.....	4	..	10
Md.....	97	115	55
Total.....	529	420	175
North Central			
Ohio.....	140	98	47
Mich.....	162	95	..
Ind.....	48	249	..
Ill.....	102	243	81
Wis.....	114	19	344
Total.....	566	684	472
South Atlantic.			
Va.....	75	97	..
W. Va.....	192	63	
N. C.....	40	175	271
S. C.....	18	199	175
Ga.....	107	203	148
Fla.....	200	111	131
Total.....	632	798	725
Canada.			
Ont. & E'n. Prov.....	102	276	110
Man.....	112	23	50
B. C.....	..	28	50
Total.....	214	327	210

States.	In process of construction.	Surveyed or under survey.	Projected.
South Central.			
Ky.....	45	20	21
Tenn.....	229	248	..
Ala.....	214	134	160
La.....	77	28	142
Total.....	565	430	326
Southwestern.			
Mo.....	99	93	4
Ark.....	98	181	25
Ind. Ter.....	30	221	..
Kan.....	..	3	
Texas.....	193	196	99
Colo.....	8	150	16
N. Mex.....	..	76	..
Total.....	428	920	144
Northwestern.			
Ia.....	..	25	20
Minn.....	102	67	54
N. Dak.....	..	30	25
S. Dak.....	227	8	40
Neb.....	24	150	30
Wyo.....	50	..	..
Mont.....	166	33	115
Total.....	569	313	284
Pacific.			
Wash.....	588	214	85
Idaho.....	71	..	..
Ore.....	25	258	42
Cal.....	23	174	48
Ariz.....	130	..	..
Utah.....	73	127	55
Nev.....	67	..	..
Total.....	977	773	230

Total for the United States: In process of construction, 4,274 miles. Surveyed or under survey, 4,630 miles. Projects of some promise, 2,371 miles.

northeast through the Adirondacks to Malone, N. Y., and thence north to Valleyfield, P. Q. It is being built in the Vanderbilt interest, and will compete with the lines of the Delaware & Hudson Canal Co. for the Adirondack and Montreal traffic.

Work in the North Central States is quite evenly distributed between the several states. The most important line under way in the three states lying east of Lake Michigan is the extension of the Wabash R. R. from Montpelier, O., to Hammond, Ind., 135 miles long. This extension will give the Wabash, which now uses the Chicago & Erie tracks from Laketon Junction to Chicago, an independent line to that place. In Illinois the Chicago & New Orleans R. R. has a line surveyed from Altamont to Paducah, Ky., 130 miles, and the Indianapolis, Decatur & Western R. R. is again talking of extending its line to Beardstown, Ill. The Duluth, Red Wing & Southern R. R. has a line surveyed in western Wisconsin from West Superior to Red Wing, Minn., 144 miles, upon which some work is likely to be done this year. The various other enterprises in this group of states are sufficiently described in the detailed list.

Turning to the South, a considerable number of important enterprises are under way in the South Atlantic and South Central groups. Work has been discontinued on many of these owing to financial difficulties, but in most cases they are but temporary, and the advanced condition of construction will insure the resumption of work at an early date. The character of the work has changed but little from that of the past few years. In most cases it consists of local lines into the mineral lands, and connections between such lines and the seaboard. One of the most important of these is the Ohio extension of the Norfolk & Western R. R., in West Virginia. This line is about 185 miles long, between Elkhorn, W. Va., and Ironton, O., and about 70 miles were completed last year and are now in operation. Work is being rapidly prosecuted on the remainder of the line, and the larger portion will probably be completed this year. In North Carolina, the Richmond & Danville and Roanoke Southern have long extensions surveyed, but there is little probability of any work being done soon. In Georgia and Alabama the more important enterprises are the Macon & Atlantic and the Montgomery, Tuscaloosa & Memphis. Both of these have been under way for some years and have done considerable construction, but work is now discontinued. There are several enterprises of considerable magnitude in Florida. Most of these are projected to develop the phosphate regions, and are sufficiently described in our detailed list.

Very little work is in progress in the Northwest. The Duluth, Mesabi & Northern has a line under contract from Duluth, Minn., north, and several lines are projected by the Minneapolis, St. Paul & Sault Ste. Marie in North Dakota. Several lines are projected in the Black Hills regions of South Dakota, and the Northern Pacific is grading a line from Aberdeen to Pierre in the same State.

In the Southwestern States the various enterprises need but little explanation in addition to the details given in the list. The Chicago, Rock Island & Pacific has renewed work on its proposed line south through Indian Territory to a connection with the Texas railway system. Among the less notable enterprises are the lines of the Choctaw Coal & Ry. Co., in Indian Territory, the Kansas City, Watkins & Gulf, the Pan American and the several lines of the Missouri Pacific Ry.

Work in the Far Western States is largely confined to the States of Montana, Idaho & Washington. By far the most important line is the Pacific extension of the Great Northern Ry. This line is all under contract. Grading is in progress on nearly 200 miles, and it is probable that a large section will be completed this season.

Taking the country as a whole, we find that there are 11,275 miles of railway projected, which have some prospect of being placed under contract or construction during the year. While this is a considerable decrease from the past two years, on the whole the outlook for engineers, contractors and others interested in railway work is quite satisfactory. There will be a fair amount of work done, probably fully as much as was done last year.

RAILWAY ACCIDENTS TO PERSONS.—III.

[Note.—As all these tables of casualties were originally computed to tenths but are here given only to the nearest unit, totals will in many cases not check within one unit.]

In a general way, it may be said that in the United States, for every passenger killed or injured there are ten employees killed or injured, and that for every passenger killed there are also ten "others" killed, though the injured are not quite so numerous. Table VIII. shows for each of the countries, states or sections we are comparing how many employees and "others" are killed for each passenger killed, and how many injured for each passenger injured. When we remember also that (see Table V. of last issue) only one-third or less of the passengers killed are killed in train accidents, the comparative insignificance of the casualties which attract most attention, those of passengers in train accidents, is evident.

Table VIII.—No. of Employees and "Others" Killed and Injured from All Causes for Each Passenger Killed or Injured.

	Employees: Killed per passenger killed.	Employees: Injured per passenger injured.	"Others": Killed per passenger killed.	"Others": Injured per passenger injured.
Northern U. S....	9.1	10.2	15.3	7.3
Southern U. S....	10.8	11.0	9.7	1.5
Western U. S.....	7 1	7.6	9.9	1.2
New York State..	9.8	8.4	15.6	2.7
Massachusetts...	2 9	2.4	6.6	1.0
Great Britain	4.2	2.3	3.9	0.2
Germany.....	7.0	16.1	7.6	1.1

In Table IX. the total number of employees killed and injured from all causes per 100,000,000 train miles is given for each country or section, with the ratio of killed to injured. The latter appear to indicate some looseness in making returns of injuries to the State Commissions of New York and Massachusetts, as may also be inferred from some other tables. In round numbers, the casualties to employees per train mile appear to be from two to three times as numerous in the United States as in Europe, and more numerous in the South than elsewhere in the United States.

Table IX.—Total Casualties to Employees from All Causes.

	Per 100,000,000 train miles.—Killed.	Per 100,000,000 train miles.—Injured.	Ratio killed to injured.
Northern U. S.....	365	2,902	1: 8.11
Southern U. S.....	453	5,000	1:10.66
Western U. S.....	272	2,723	1:10.00
New York State.....	221	936	1: 4.23
Massachusetts.....	194	744	1: 3.85
Great Britain.....	161	1,066	1: 6.35
Germany.....	194	1,473	1: 7.62

Taking up the several causes of these casualties, Table X. shows the deaths and injuries in coupling cars per 100,000,000 train miles, per 100,000,000 freight train miles, and per 100,000,000 ton-miles of freight the last the fairest unit for comparing this class of casualties, unless it might be claimed that the ton carried, regardless of haul, was the fairest unit. In that case, the average haul in Britain being only 35 miles, against 120 in the United States, the British totals should be correspondingly reduced to about one-third of their magnitude above.

The result would be that in numbers killed Great Britain and the United States would stand substantially on an equality, but in number of injured we should lead. Keeping all things in view the humanitarian argument for some better form of coupling is at least as strong in Great Britain as here, and the fact that not the first move in that direction has yet been made there, even in the way of agitation, while here the pressure for a change has for years been very great, so that one-fifth of our freight cars now have automatic couplers, has a certain significance.

Table X.—Employees and Others Injured in Coupling Cars.

	Per 100,000,000 train-miles			Do. per 100,000,000 frt. train miles.
	Killed.	Injured.	Total.	
No. U. S.	51	1,163	1,214	2,080
So. U. S.	66	1 683	1,749	2,815
W. U. S.	46	815	861	1'388
New York... Emp.	18	477	498	848
New York... Others	1	2		
*Mass.	19	378	397	826
Gt. Britain	42	531	573	1,242

	Per 100,000,000 ton-miles.			Av. wt. frt train.
	Killed.	Injured.	Total.	Tons.
No. U. S.	0.43	9.6	10.0	207
So. U. S.	0.73	18.3	19 0	147
W. U. S.	0.51	9.0	9.5	146
New York... Emp.	0.15	4.0	4.2	214
New York... Others	0.01	...		
*Mass.	0.37	7.4	7.8	107
Gt. Britain	1.2	15.5	17.7	74

*For 4 years, 1887-90. For former years not deducible from returns.

N. B.—The average haul is an important element to consider in this table. For Great Britain it is only 35 miles; for Massachusetts, 70 miles; for the Northern U S., about 96 miles; Southern U. S., about 128 miles; Western U. S., about 160 miles. Hence from two to five times as many separate tons are handled in Great Britain to make up 100,000,000 ton miles as in the United States, with a correspondingly greater liability to coupling accidents.

The casualties to employees from falling from trains or getting on or off in motion are shown in Table XI. They will be seen to be greatly more numerous per train mile in this country than in Great Britain, owing to the way in which our trainmen run all over the train to apply brakes, whereas in England there are no brakes to apply except on the "brake van." Most of this loss of life and limb will disappear in a few years, when freight train brakes become universal. In England there has not been as yet any movement toward applying the train brake to general freight service, but it is used in many cases on milk trains and other special classes of trains in freight service.

Table XI.—Casualties to Employees and (so Far as reported) "Others" from Falling from Trains and Getting On and Off in Motion.

	Per 100,000,000 train miles.		
	Killed.	Injured.	Total.
No. U. S. employees	85	288	373
So. U. S. "	97	575	672
W. U. S. "	63	302	365
N. Y. employees	50	148	342
N. Y. others	57	98	
Mass. employees*	68	142	323
Mass. others	52	61	
Gt. Britain employees	7	89	96

	Per 100,000,000 freight train-miles.		
No. U. S. employees	146	495	641
So. U. S. "	156	925	1,081
W. U. S. "	101	487	588
N. Y. employees	100	250	579
N. Y. others	63	166	
Mass. employees*	106	345	773
Mass. others	121	141	
Gt. Britain employees	16	194	210

*For 4 years 1887-90: For prior years not deducible from reports. Casualties due to getting on and off trains in motion not included.

An enormous number of trespassers are killed and injured by falling from trains or jumping on and off in motion, as will be seen from the returns for New York and Massachusetts in Table XI. The interstate reports have no line for casualties to "others" from falling from trains, and consequently the casualties of this kind go to swell the enormous aggregate of miscellaneous or unclassified casualties which is one of the most objectionable features of the interstate returns. Another year we trust this will be remedied.

For New York State and Great Britain only have we separate and distinct reports of casualties (1) from (voluntary) getting on and off trains in motion and (2) from falling from trains. These records compare as follows:

Table XII—Casualties from (1) Voluntary Jumping On and Off Trains; (2) Falling from Trains or Engines.

	Employees.		Passengers.		Others.	
New York State, per 100,000,000 train miles.	K.	Inj.	K.	Inj.	K.	Inj.
(1) Jumping	10	56	6	30	23	77
(2) Falling	46	86	4	11	13	17
Great Britain, per 100,000,000 train miles.						
(1) Jumping	5	63	..	..	..	..
(2) Falling	2	26	5	9	..	..

It will be seen that in this matter our practice compares most unfavorably with that of Great Britain. In the first place, not a few passengers are killed and injured by jumping off trains in motion, which they cannot do in Great Britain. In the second place, we kill many more employees in this way, especially by involuntary falling. In the third place we kill great numbers of tramps and trespassers in both ways, whereas abroad they are not suffered to get near the trains.

Table XIII.—Casualties to Employees from Overhead Obstructions.

	Per 100,000,000 train miles.		
	Killed.	Injured.	Total.
No. U. S.	13	46	59
So. U. S.	28	93	121
W. U. S.	7	38	45
New York	5	20	25
Massachusetts*	9	24	33
Great Britain	3	13	16

* For 4 years 1887-90. For prior years not deducible from reports.

It is natural that there should be far more casualties from overhead obstructions at home than abroad, since our trainmen travel over the trains when in motion far more than is customary abroad, It is difficult to see why there should be so large a proportion of such accidents in the South, as there are there comparatively so few structures over the track. Possibly the milder weather there leads to the employees being some of their time on top of trains.

There properly ought to be a good many "others" reported as killed and injured by overhead obstructions, since many such casualties occur. But none are reported in any of the returns analyzed except two or three in New York State, which we neglect as plainly incomplete.

We now come to the important class of casualties from train accidents, which we will consider as a whole and for all classes of persons together, per 100,000,000 train miles. Owing to the imperfection in the interstate reports to which we have already alluded, viz., the improper charging of many casualties caused by trains to "other train accidents" which properly includes only a very limited list of casualties from boiler explosions, trains on fire, etc., we are obliged to regard collisions and derailments only as train accidents, neglecting the "other" train accidents. Table XIV. shows the proportion of casualties from such accidents to the total casualties for passengers, employees and "others" separately.

Table XIV.—Relative Number of Casualties from Train Accidents (Collisions and Derailments Only) and from All Other Causes.

		Per 100,000,000 train miles. Passengers.		Employees.		Others.	
		Killed.	Inj'd.	Killed.	Inj'd.	Killed.	Inj'd.
No. U. S.	Train ac..	8	109	42	150	3	16
	All other.	32	122	323	2,812	613	656
So. U. S.	Train ac..	15	247	115	592	8	18
	All other.	28	209	348	4,408	408	652
W. U. S.	Train ac..	14	212	50	257	6	17
	All other.	24	146	222	2,466	371	430
N. Y.	Train ac..	9	55	30	80	2	4
	All other.	14	55	187	839	350	288
Mass	Train ac..	[Not deducible.]		20*	62*	[Not deducible.]	
	All other.			193*	161*		
British..	Train ac..	6	140	3	38	...	...
	All other.	32	299	158	958	148	77
German.	Train ac..	8	62	5	128	1	4
	All other.	20	30	189	1,345	212	95

* For 4 years, 1887-90. For previous years not deducible.

Table XIV. is worthy of some study. It teaches a great moral lesson which in part has been already told by Table VIII. The insignificant fraction which the passengers killed and injured in train accidents are of the total of killed and injured is evident at a glance, but to fully take in the contrast between American and foreign practice which the table reveals takes some little study.

In passengers killed and injured by train accidents and by other causes we compare sufficiently well, when the difference in train loads and other operating conditions are considered. Certainly when we compare New York State with Great Britain and Germany it is difficult to see wherein the little use of block systems is so very deadly.

In employees killed and injured by train accidents our returns uniformly show far more than abroad, and in employees killed and injured by other causes we also compare unfavorably, though in less degree.

In "others" killed and injured we are out of sight ahead of the foreign returns. As a rude average, we kill and injure twice to thrice as many "others" as abroad, or 200 to 400 more killed and 200 to 400 more injured per 100,000,000 train miles, the total deaths of passengers being only 30 to 40 and the total injuries of passengers 100 to 400. These facts we will consider a little more fully later.

In the meantime, to make still clearer how small a proportion of the total are the persons killed in train accidents, we give in Table XV. a summary of Table XIV., with another column added, showing separately the alleged casualties from "other train accidents." It is evident at once that the interstate returns for the latter are quite defective, since they report nearly as many deaths from these rare accidents as from collisions and derailments.

Table XV.—Summary of the Distribution of Accidents to All Persons, to Train Accidents and Other Causes.

	Per 100,000,000 train miles. From collisions and derailm'ts.		From other train accidents.		From all other causes.	
	Killed.	Inj'd.	Killed.	Inj'd.	Killed.	Inj'd.
No. U. S.	53	275	54	163*	914	3,487
So. U. S.	138	857	102	437	681	5,832
W. U. S.	70	486	74	165	544	2,875
N. York	49	138	15	80	536	1,102
Mass.	28	142	..	..	660	1,354
Gt. Britain	9	178	1	18	338	1,326
Germany	15	195	..	..	419	1,469

* Untrustworthy. Most of them should be included in the last two columns of the table, and not under "other train accidents," as explained in text.

In the aggregate of casualties from the latter causes, shown in the first two columns, we make a poor comparative showing because of our great excess of employees killed in train accidents, as shown in Table XIV., though in casualties to passengers only from train accidents we compare very respectably.

Table XVI. shows the casualties per 100,000,000 train miles from collisions, detrailments and other train accidents separately, for passengers only, employees only, and in total.

Table XVI. Casualties from Collisions, Derailments and Other Train Accidents.

Per 100,000,000 train miles.

A. Casualties to All Persons from Train Accidents.

	Collisions.		Derailments.		Other train ac.	
	Killed.	Inj'd.	Killed.	Inj'd.	Killed.	Inj'd.
No. U. S.	41	192	12	83	54	163*
So. U. S.	73	395	65	462	102	437
W. U. S.	34	221	36	283	74	165
New York	35	117	5	21	15	80
Mass.	8	44	20	98	[not reported.]	
Gt. Britain	8	167	1	11	1	18
Germany	10	191	4½	54	...	...

B. Casualties to Passengers Only from Train Accidents.

No. U. S.	6	69	3	40	3	25*
So. U. S.	4	82	14	165	9	40
W. U. S.	8	76	6	136	4	32
New York	9	46	...	9	1	4
Mass.	[Not deducible from state reports.]					
Gt. Britain	6	134	...	6	...	10
Germany	8	54	...	8	...	...

C. Casualties to Employees Only from Train Accidents.

No. U. S.	33	113	6	37	16	104*
So. U. S.	66	303	49	280	22	277
W. U. S.	22	134	28	123	22	81
New York	25	67	4	13	13	68
Mass	[Not deducible from state reports.]					
Gt. Britain	2	33	1	5	1	8
Germany	1	83	4	45	...	...

* Returns worthless and to be disregarded. Most of these casualties are merely caused by trains, and are in no sense the effect of accidents to trains; therefore do not belong in this table at all. The same is, perhaps, true in some degree of the New York State casualties.

It will be seen from Table XVI. that in the Northern United States, New York State, Great Britain and Germany, casualties from derailments are comparatively rare, and greatly less frequent than casualties from collisions. This is true not only of passengers (which we saw last week) but also of employees and of all classes together. In Massachusetts, despite its heavy traffic of both passengers and freight, derailment casualties are the more common of the two.* We have looked over the returns

*Had we not omitted the Bussey bridge casualties from the Masschusetts returns this excess of derailment casualties over collisions would have been still more conspicuous. To avoid all misconception it will be well to explain again why fairness demanded this omission. In

TABLE XVIII.—DETAIL TABLE OF CASUALTIES PER 100,000,000 TRAIN MILES IN THE NORTHERN, SOUTHERN AND WESTERN STATES, NEW YORK STATE, MASSACHUSETTS, GREAT BRITAIN AND GERMANY.

GIVING SEPARATELY DEATHS AND INJURIES OF PASSENGERS, EMPLOYEES AND OTHERS, AND THE TOTAL DEATHS AND INJURIES.

CAUSES OF ACCIDENTS. [Those numbered 1 to 9 are the interstate commerce classifications. Those with half numbers are causes of accidents included in other reports, but not in the interstate reports.]	Northern U. S. (east of Chicago). One year, ending June 30, 1890.								Southern U. S. (east of Miss. Riv.) One year, ending June 30, 1890.								Western U. S. One year, ending June 30, 1890.								New York State. Two years, ending June 30, 1890-91.							
	Employ's.		Pass'ng'rs.		Others.		Total.		Employ's.		Pass'ng'rs.		Others.		Total.		Employ's.		Pass'ng'rs.		Others.		Total.		Employ's.		Pass'ng'rs.		Others.		Total.	
	K'l'd.	Inj.	K'l'd.	Inj.	K'l'd.	Inj.	K'l'd.	Inj.	K'l'd.	Inj.	K'l'd.	Inj.	K'l'd.	Inj.	K'l'd.	Inj.	K'l'd.	Inj.	K'l'd.	Inj.	K'l'd.	Inj.	K'l'd.	Inj.	K'l'd.	Inj.	K'l'd.	Inj.	K'l'd.	Inj.
1. Coupling and uncoupling	52	116	Not reported.				52	116	66	1,085	Not reported.				66	1,085	46	815	Not reported.				46	815	18	477			18	477
1½. Closing carriage doors	85	288					85	288	97	575					97	575	63	302					63	302	46	85	4	11	50	96
2. Falling from trains and engines	13	46					13	46	26	93					26	93	7	38					7	38	5	20			5	20
3. Overhead obstructions																														
3½. Putting arms out windows, etc.	33	115	6	60	2	10	41	102	66	362	1	82	6	11	73	395	32	134	8	76	4	11	34	241	25	67	9	46	1	4	35	117
4. Collisions	9	37	3	40	1	6	12	83	49	289	14	165	2	7	65	462	28	123	6	130	2	6	36	265	4	11		9	1	1	5	29
5. Derailments																										1				1
6. Failure of structures	16	104	3	25	35	34	54	163	32	277	10	40	60	119	102	436	22	81	4	32	47	53	73	166	11	64	1	8	13	78
6½. Other train accidents																									2	4			2	4
6¾. Locomotive explosions																														
7. At highway crossings	5	6	1	2	71	107	77	115	2	4	1	..	91	70	25	74	1	4	..	..	46	81	47	85	88	81	2	3	51	98
7½. Walking or being on track	15	90	9	60	56	64	80	214	22	218	3	50	69	102	91	370	9	84	3	30	31	56	43	169					256	117
8. At stations																														
8½. Catching foot in frog	138	1,115	19	86	450	451	608	1,651	160	1,550	14	109	237	391	371	2,029	74	1,142	17	83	247	240	338	1,465	1	36		3	1	39
9. Other causes																									1	5			1	5
9½. Not caused by train or cars																														
Totals per 100,000,000 train miles	265	2,002	40	291	615	672	1,021	3,025	462	5,050	43	455	416	670	921	6,125	273	2,723	38	357	377	447	687	3,527	217	913	23	110	352	292
																													792	1,321

CAUSES OF ACCIDENTS. [See note above.]	Massachusetts. Four years, 1887-90, or 5 years, 1885-89.								Great Britain. One year, 1890.								Germany. One year, 1888-7.							
	Employ's.		Pass'ng'rs.		Others.		Total.		Employ's.		Pass'ng'rs.		Others.		Total.		Employ's.		Pass'ng'rs.		Others.		Total.	
	K'l'd.	Inj.	K'l'd.	Inj.	K'l'd.	Inj.	K'l'd.	Inj.	K'l'd.	Inj.	K'l'd.	Inj.	K'l'd.	Inj.	K'l'd.	Inj.	K'l'd.	Inj.	K'l'd.	Inj.	K'l'd.	Inj.	K'l'd.	Inj.
1. Coupling and uncoupling	19*	375*	..	..	..	..	..	..	42	331	..	40	..	..	42	331	[No other figures than those here given were determined from the reports, though all determinable.]							
1½. Closing carriage doors											..	40	..	..	..	40								
2. Falling from trains and engines	68*	142*	..	..	52	61	..	..	2	26	4	9	..	..	7	35								
3. Getting on and off in motion									5	65	..	..	..	..	5	65								
3. Overhead obstructions	0*	24*	..	..	..	..	..	..	3	13	..	..	..	..	3	13								
3½. Putting arms out windows, etc.	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..								
4. Collisions	20*	62*	[All figures not given in this table are not deductible from reports.]				8	44	2	33	6	134	..	..	8	167	1	83	8	54	1	4	10	142
5. Derailments							20	96	1	5	..	6	..	..	1	11	4	45	..	8	95*	10*	5	64
6. Failure of structures									..	..	..	10	..	..	1	17								
6. Other train accidents									..	..	..	..	..	..	..	1								
6½. Loco. explosions									..	1	..	..	..	..	..	1								
7. At highway crossings	97*	217*			68	78			..	..	..	..	97	11	97	12								
7½. Walking or being on track					309	157			92	234	19	205	166	40	186	274								
8. At stations					14	16			11	57			..	..	30	282								
8½. Catching foot in frog					..	..			3	35	9	35	15	36	27	96								
9. Other accidents					..	..			..	..	..	..	..	..	..	..								
9½. Not caused by train or cars					..	..			..	..	..	..	..	..	..	..								
Totals per 100,000,000 train miles	213*	823*	681	3063	462	310	704†	1,3601	161	1,003	38	439	148	77	347	1,522	194	1,473	28	92	212	99	434	1,664
	194	744	32	241			688	1,295																

* These figures are for the four years 1887-90; the remainder for the five years 1885-1889.
† These figures include the Bussey Bridge disaster; those below them do not.

* All suicides, with one or two exceptions.

order to compare approximately equal volumes of traffic we are comparing one year's returns for the sections of the United States, Great Britain and Germany, with the aggregate of two years' returns for New York and of five years' returns for Massachusetts. In no one of these periods except that of Massachusetts did any single great casualty occur materially increasing the aggregates. If we were taking the aggregates of a long series of years in each case, or if we were comparing a single year in each case, then it would be proper to include all casualties, great or small; but it would be unfair to go back five years in the case of Massachusetts, and thus get in the Bussey Bridge disaster, and not go back even one year in the case of Great Britain, for example, and thus include the Armagh disaster, which in comparing the returns for Great Britain and the United States for 1889 (June 7, 1890), we also omitted as something entirely exceptional.

of that state for many years past, and are compelled to conclude that this difference is a normal one, and due in part to inferior track practice in that state, in respect to rails, frogs and switches, bridges and other like details, as also, possibly, to the use of a larger percentage of old and inferior rolling stock.

In the Southern and Western United States the casualties from collisions and derailments are pretty evenly divided, and from both causes, in the South especially, pretty heavy. These interstate statistics, beyond question, will have a tendency to improve practice in the South, by revealing what before could not be known, that railway casualties of all kinds (except collisions of passenger trains) are much more common there than elsewhere.

We now come to the final classes of casualties, those due to being on the track at the wrong time. Subdivisions of this great class are (1) casualties at highway crossings, (2) at stations, (3) to walking or being on track, (4) to catching foot in frogs and the like, as also (5) the all-embracing term "other causes," under which many casualties are reported for lack of details which really belong somewhere else. Especially is this true of the interstate report, which has no separate line even for so vast a class of casualties as "walking or being on track," but lumps all such among "other causes." Table XVII. gives the aggregate casualties from all the above causes, for passengers, employees and "others" separately, but there are such great differences of subclassification in the different returns that it is useless to attempt to compare these more in detail.

Table XVII.—Aggregate Casualties to Passengers, Employees and "Others" from Walking or Being on Track at Highway Crossings and Stations, and Other Miscellaneous or Unclassified Causes:

	Per 100,000,000 train miles, —Passengers— Killed.	Inj'd.	—Employees— Killed.	Inj'd.	—Others— Killed.	Inj'd.
No. U. S...	29	157	158	1,210	577	623
So. U. S...	18	168	124	1,780	347	533
W. U. S...	20	114	84	1,230	324	376
New York.	3½	3½	95	132	311	185
Mass.....	[Not deducible.]		97*	217*	309	250
Gt. Br't'n.	28	240	106	327	148	77
Germany .	18†	24†	126†	459†	114	85

* For four years only; the other Massachusetts statistics are for five years.
† In part estimating by subdividing in proportion to the British ratios, and possibly 10% more or less in error.

We give in the large Table XVIII., however, a complete statement of the deaths and injuries per 100,000,000 train miles (both passenger and freight) for each reported cause in each section, state or country which we have compared, and for passengers, employees and others separately. In this way a general comparative view of the whole returns can be obtained, if one takes pains enough, and the nature of the differences or defects in classification seen more clearly than we can explain them. Given this table and the details of train mileage, etc., given in Table II. of the first article of this series, and the casualties per any other unit likely to be desired can be easily computed.

In Table XVIII. the classes of casualties having even numbers from one to nine are those of the interstate reports. The classes having half numbers, of which there are no less than seven, are those found in the British or New York state returns which it seemed reasonable or desirable to distinguish from the even-numbered interstate classifications. The half numbers were so assigned as to bring each class adjacent to the interstate class with which it appeared to have most analogy.

We conclude, as we began, by stating that the "train mile" considered throughout these articles has been revenue train mileage, excluding all that "other" engine mileage, chiefly switching, which is really not train mileage at all, though the Massachusetts and some other returns erroneously class it as such.

The two little tables below (XIX., XX.) appropriately round out this article by giving "the conclusion of the whole matter." They sufficiently explain themselves.

Table XIX.—Total Casualties to "Others" from All Causes, Including Suicides.

	Per 100,000,000 train miles. Killed.	Injured.	Total.	Ratio killed to inj'd.
Northern U. S.....	615	672	1,287	1:1.09
Southern U. S.....	415	670	1,085	1:1.61
Western U. S.....	377	447	824	1:1.18
New York.....	338	297	635	1:0.88
Massachusetts.....	443	310	753	1:0.70
Great Britain.....	148	77	225	1:0.52
Germany.....	213	98	311	1:0.48

Table XX.—Total Casualties of All Kinds to All Classes of Persons.

	Per 100,000,000 train miles. Killed.	Injured.	Total.	Ratio killed to inj'd.
Northern U. S.....	1,021	3,975	4,996	1:3.85
Southern U. S.....	971	6,125	7,046	1:6.64
Western U. S.....	688	3,527	4,415	1:5.12
New York State. ..	602	1,345	1,947	1:2.23
Massachusetts.....	688	1,285	1,983	1:1.88
Great Britain.....	347	1,522	1,869	1:4.40
Germany.....	434	1,661	2,097	1:3.84

Chemical and mechanical tests of the various building stones of Washington are to be made by Mr. F. G. Plummer, of Tacoma, engineer to the State University Commissioners.

A portion of Stuck River, in Washington, near Dieringer, is to be straightened. The engineer in charge, Mr. Fred. G. Plummer, of Tacoma, Wash., has designed a system of mattresses to protect the sides of the new channel until the current cuts to the desired depth.

LETTERS TO THE EDITOR.

CONTINUOUS BRAKES ON ENGLISH RAILWAYS.

Sir: We note the article on this subject in your issue of Jan. 30. With regard to the handling of our brake on the London, Chatham & Dover Ry., we can only say that it is anything but as we should wish. No doubt, improvement will be made as the employees in charge of the trains become more accustomed to its use. The progress, however, will not be so rapid as on other lines, since the London, Chatham & Dover Ry. will not accept the services of our inspectors, whom we are always ready to send to teach the railway men the proper method of working the brakes. We have pleasure in sending you a copy of each of our illustrated books. From the reference books you can obtain all information as to the railways using our brake, except the mileage, which we have never obtained. The "brake instruction cars" are fitted by the railway companies themselves, we supplying our patented automatic parts as for the ordinary rolling stock.

Yours faithfully, Alb. Kapteyn,
Gen. Man. and Secy., Westinghouse Brake Co.

London, Feb. 17, 1892.

Sir: In regard to the article on continuous brakes in Engineering News, Jan. 30, I have pleasure in sending you some information on the subject of brakes which may be interesting to you. With reference to "brake instruction cars," these are not necessary with our system, it being so simple that the men have no difficulty in learning off-hand what they have to do, as the mechanical contrivances are in no way complicated, and no particular amount of examination of the details is required, there being so few frictional parts. I also send you a report of the brake trials in India and in New South Wales, where you will see that the decision of the experts was 4 to 1 in our favor against the Westinghouse brake. I also send you a pamphlet by Mr. Kiernan on "Continuous Brakes: Their Recent Development," which is very interesting, and also one by Mr. Marshall on "Railway Brakes." Probably from time to time some of this information may be interesting to your readers. Yours faithfully,

Alfred L. Sacré,
Managing Director, Vacuum Brake Co.

London, Feb. 13, 1892.

Sir: I note in Engineering News of Jan. 30 an article on "Continuous Brakes on English Railways." With reference to the vast difference between the returns of the London, Chatham & Dover Ry. Co. and the London, Brighton & South Coast Ry. Co., it will be apparent to any one who reads the Blue Book giving returns by all the companies, that the directions of the Board of Trade as to the cases to be reported are not strictly complied with by all the companies. The Westinghouse brake has only been fitted to the bulk of the London, Chatham & Dover Ry. Co.'s stock during the last three years, and the efficient working of it cannot come to the drivers all at once, but is a matter of time; hence the large proportion of irregularities due to error in judgment or fault of the driver. The brake has been always carefully and properly maintained on that line, the same as other parts of the engine. The London, Brighton & South Coast Ry. Co., as stated in the article, has had the brake in use many years, but on reference to the return it will be seen that with other companies on whose lines the brake has been adopted nearly as long, the failures and instances of delays very much exceed those returned by the London, Brighton & South Coast Ry. Co., and the inference is, I think, that the number of failures and instances of delay are minimized in the return. Yours faithfully, W.

London, Feb. 17, 1892.

SIR: I have read with interest the article in your issue of Jan. 30. The returns on brakes made to the Board of Trade are "at least very strange." Certain lines do not make true returns. Private feeling or interest in many cases leads to the defects being not reported, and in other cases to delays or faults being put down when there is no cause. Yours faithfully, C.

London, Feb. 12, 1892.

[It is fortunate that there is not in this country any conflict between what is admittedly the most efficient brake, and a cheaper, simpler and less effective brake, such as that which exists abroad and of which the above correspondence is an echo. For the moment the cheaper and less effective brake seems to be gaining on the other in England, the excuse being (for we cannot regard it as anything but an excuse) that it is the simpler as well as cheaper. But that it is so much simpler as not to require instruction of employees for its proper use, as claimed in one of the letters given above, is not a tenable position. Of course with either brake, or with the locomotive itself, the men may "have no difficulty in learning off-hand what they have to do," to the extent that moving a handle in one direction will set things going, and moving it the other way will have a reverse effect, but this is not generally held to be a sufficient or safe standard of knowledge for handling such appliances, which in each case are of an intricate and delicate nature. It should be added, moreover, in justice to the Vacuum automatic brake, that it if be not the first and best, it is a very good second, and is a thoroughly practical and efficient device.

From a table in the Westinghouse Brake Co.'s reference book we find that up to June 30, 1888, there were in Europe, India and Australia 75 railways having 7,096 locomotives and 52,370 cars equipped with the Westinghouse automatic brake. According to a return made to the Board of Trade for the first half of 1888, there were then in England 1,915 locomotives and 14,838 cars fitted with the Westinghouse automatic brake, and 3,588 locomotives and 17,750 cars with the Vacuum automatic brake. The tests made in India in 1888 resulted in the adoption of the Vacuum automatic brake for the Indian State Railways, but the report stated that the Westinghouse brake was superior in emergency stops, though both brakes were thoroughly efficient. Particulars of the brake tests in South Australia and New South Wales were given in our issues of Aug. 1 and 15, and Oct. 24, 1891. In both cases the adoption of the Westinghouse brake was recommended. In New South Wales, the report referred to in the above letter from the Vacuum Brake Co. stated that both brakes had shown such excellent results that the adoption of either would be fully justified, the tests, however, being in favor of the Vacuum brake (one member of the Board dissenting), but that in view of the extensive use of the Westinghouse brake on passengers cars in this colony and Victoria, it should also be adopted for freight cars.—ED.]

THE SECOND LEHIGH VALLEY BRAKE TESTS.

Sir: When it was found that the action of the old style triple valve of the New York Air Brake Co. was slower than was desirable, the emergency feature was modified to quicken it. It was very important that the action of the new valves should be shown on 50-car trains in actual service, in order to obtain an official record regarding their efficiency in applying the brakes to the last car and in stopping trains as quickly as possible. Two opportunities were offered where such tests might be made if sets of valves could be supplied within a very limited time; the first on the Chicago, Burlington & Quincy R. R., and the second on the Lehigh Valley R. R. The valves for both these tests were rushed through the shop in the same week and were only completed in time by working night and day. It is not strange, therefore, that they were not finished as carefully as they should have been. They were tested to see that the application was within the three-second limit and that they would release with the proper handling of the engineer's valve, but there was no time for refined shop tests. To this cause alone is due the failure of some of the valves to release properly on those tests. We desired to postpone the Lehigh Valley test until we could get another set of valves finished with proper care; but as everything else was ready, it was decided to make the runs to determine the efficiency of stopping, and make a test of a second lot of the valves the next week. This second lot of valves were duplicates of the first except that they had received proper care in manufacture.

This second test occurred Thursday, Feb. 25, at Packerton, on the Lehigh Valley R. R. [A full report of these tests is given elsewhere.—Ed.] The perfect manner in which the brakes released under all conditions dispels the criticism that "the construction of this triple valve precludes the securing of a sure release without such modifications as will seriously interfere with other equally important functions." There was no modification or alteration whatever, simply less haste in manufacture.

We are now ready to supply triple valves which are just as sure to release as the Westinghouse valves, whether used with our duplex pump and our engineer's valve or with the Westinghouse pump and the Westinghouse engineer's valve. Moreover, our valves perform all other functions fully as well as, and some functions better than the Westinghouse.

The superiority of our engine equipment has been demonstrated, and we feel that we are to be congratulated because of our full success in producing a car equipment which is also practically superior to any other brake in the market.

We also congratulate the railways that they are now released from the monopoly which has so long existed in the manufacture of air brakes. Competition has not only improved the quality, but reduced the price, as it always does. We therefore feel sure that the railways will sustain us in our competition.

The New York Air Brake Co.,
C. A. Starbuck, Vice-Prest.

New York, March 2, 1892.

STATISTICS SHOWING THE PROSPECTIVE RAILWAY CONSTRUCTION OF 1891.

(Concluded from page 221.)

SOUTH CENTRAL.

Kentucky.

Fordsville, Hartford & Southwestern.-Projected, Fordsville to Hartford, 24 miles. Ch. Engr., John J. McHenry, Hartford.

Ohio Valley.—Under contract, Gracey to Hopkinsville, 10 miles.

Owensboro, Falls of Rough & Green River.—Under survey, Fordsville to Coneyville, 20 miles.

Richmond, Nicholasville, Irvine & Beattyville.—Partly Graded, Irvine to Beattyville, 35 miles. Ch. Engr., J. H. Pearson, Louisville.

Total.—Under contract or construction, 45 miles. Surveyed or under survey, 20 miles. Projected, 24 miles.

Tennessee.

Bristol Belt Line.—Surveyed, Bristol to Blountville, 11 miles. Gen. Man., W. A. Stadleman, Bristol.

Bristol, Elizabethton & North Carolina.—Graded, Bristol to Elizabethton, 20 miles. Under contract Elizabethton to Mountain City, 40 miles. Surveyed, Elizabethton to Irwin, 18 miles. Ch. Engr., Geo. S. Bruce, Bristol.

Decatur, Chesapeake & New Orleans.—Partly graded, Lincoln Co. line to 2 miles south of Shelbyville, 13 miles. Ch. Engr., W. H. Calhoun, Fayetteville.

Harriman Coal & Iron.—Graded, Harriman to Brushy Mt., 14 miles. Ch. Engr., J. P. Suverkrop, Harriman.

Louisville & Nashville.—Surveyed, Marion to Van Leer 7 miles.

Middle & East Tennessee.—Surveyed, Hartsville to Carthage, 15 miles.

Missouri, East Tennessee & Virginia Air Line.—Under contract, Knoxville to Rockwood, 60 miles. Pres., Geo. M. Buttrick, Everett, Mass; Ch. Engr., L. E. Wolkins, 258 Washington St., Boston.

Nashville & Knoxville.—Graded, Chimney Springs to Standing Stone, 13 miles. Surveyed, Standing Stone to Cincinnati Southern Ry., 40 miles. Ch. Engr., R. J. Moscrip, Cookeville.

Paducah, Tennessee & Alabama.—Projected, Hollow Rock to Florence, Ala., 115 miles. Ch. Engr., N. R. Alcott, Paris.

Shelbyville, Nashville & Northern.—Surveyed, Shelbyville to Nashville, 50 miles.

Tennessee Midland.—Surveyed, Perryville to Nashville, 92 miles.

Unaka & Nolachucky.—Under contract, Erwin to Newport, 55 miles. Ch. Engr., R. A. Bowie, Greenville.

Watauga Valley.—Under construction, end of '91 track to Watauga Point, 3.9 miles. Ch. Engr., J. C. Englebert, South Watauga.

Total.—Under contract or construction, 229 miles. Surveyed or under survey, 218 miles.

Alabama.

Alabama Grand Trunk.—Under contract, Montgomery north, 10 miles. Pres., H. G. McCall; Engr., C. P. Rogers, Sr., both of Montgomery.

Birmingham & Jones Valley.—Under construction, Avondale to Springville, 25 miles. Ch. Engr., C. O. Lagerfelt, Birmingham.

Birmingham, Columbus City & St. Louis—Projected, Guntersville to Scottsboro, 30 miles. Pres., W. E. Baskett, Chattanooga.

Birmingham, Sheffield & Tennessee River.—Surveyed, South Parrish to Birmingham, 40 miles.

Decatur, Chesapeake & New Orleans.—Partly graded between Decatur and the Tennessee line, 18 miles.

Escambia.—Surveyed, Steadham to Little River, 7 miles.

Florence Northern.—Graded, Florence north, 27 miles.

Gurley & Paint Rock Valley.—Located, Winchester, Tenn., to Deposit, 65 miles. Pres., F. B. Gurley, Gurley.

Louisville & Nashville.—Projected, Sylacauga to Wetumpka, 50 miles.

Montgomery, Haynesville, & Camden.—Projected. Camden to Montgomery, 73 miles. Ch. Engr., C. P. Rogers, Letohatchee.

Montgomery, Tuscaloosa & Memphis.—Partly graded, Montgomery to Tuscaloosa, 107 miles.

Nashville, Chattanooga & St. Louis.—Under contract, South Guntersville to Bell Factory, 37 miles.

Ohatchie Valley.—Surveyed, Lions mines to Piedmont, 12 miles.

Tennessee River, Asheville & Coosa.—Located, Asheville to Coosa River 10 miles.

Tredgar Mineral.—Projected, Tredgar June. to Iron Mountain, 6.5 miles. Ch. Engr. Geo. H. Montgomery, Jacksonville.

Total.—Under contract or construction, 214 miles. Surveyed or under survey, 134 miles. Projected, 160 miles.

Louisiana.

Kansas City, Watkins & Gulf.—Tracklaying in progress, 50 miles north of Lake Charles to Alexandria, 40 miles. Ch. Engr., P. H. Philbrick, Lake Charles.

Louisiana Nickelplate.—Partly graded, Allentown to Bellevue, 12 miles, W. G. Wadley, Houghton.

Louisville, New Orleans & Texas.—Under survey, Ethel to Jackson, 5 miles.

Missouri Pacific.—Projected, Eldorado, Ark., to Alexandria, La., 12 miles.

Natchez, Red River & Texas.—Projected, Trinity to Alexandria, 42 miles.

New Orleans & Northwestern.—Partly graded, Rayville to Bastrop, 25 miles. Ch. Engr., W. Dunbar Jenkins, Natchez, Mass.

New Orleans, Ft. Jackson & Grand Isle.—Surveyed, Grand Bayou to Grand Isle, 8 miles. Supt., C. S. Dwight, New Orleans.

Southern Pacific.—Surveyed, New Iberia to Abbeville, 15 miles.

Total.—Under contract or construction, 77 miles. Surveyed or under survey, 28 miles. Projected, 142 miles.

SOUTHWESTERN.

Missouri.

Cleveland, St. Louis & Kansas City.—Partly graded, St. Charles to Alton, 20 miles; Hamburg to Pinkney, 36 miles.

Kansas City & Independence Air Line.—Track laid, Kansas City to Independence, 5.5 miles.

Kansas City, Bentonville & Southeastern.—Partly graded, Pineville to Bentonville, Ark., 25 miles. Ch. Engr., T. M. Long, Bentonville, Ark.

Kansas City, Nevada & Ft. Smith.—Surveyed, Hume to Fort Scott, 25 miles.

Kansas City Suburban Belt.—Projected, extension west to state line, 4 miles. Ch. Engr., J. W. Heylman, Kansas City.

Missouri Pacific.—Located, Joplin to Seneca, Kan., 10 miles. Surveyed, Boonville to Jefferson, 46 miles.

Missouri Southeastern.—Under construction, Bloomfield to the St. Louis Southwestern Ry., 6.5 miles. Pres., Geo. H. Crumb; Ch. Eng., C. W. McCrea; both of Bloomfield.

Montgomery & Western.—Surveyed, end of '91 track to Fulton, 15 miles. Pres., Jas. Ferguson; Ch. Engr., J. S. McCleary; both of Montgomery.

St. Louis & Hannibal.—Under construction, Perry to New London, 18 miles; Oakwood to Hannibal, 3 miles.

Total.—Under contract or construction, 99 miles. Surveyed or under survey, 93 miles. Projected, 4 miles.

Arkansas.

Hope & Lewisville.—Under construction, end of '91, track to Hope, 17 miles. Pres. John A. Roberts, New Lewisville. Ch. Engr., M. D. Tilson, Texarkana.

Kansas, Arkansas & New Orleans.—Located, Beebe to Stuttgart, 50 miles.

Kansas City, Ft. Smith & Southern.—Under survey, Sulphur Springs to Ft. Smith, 10.6 miles.

Mississippi & Little Rock.—Partly graded, end of '91 track to Argenta, 26 miles.

Prescott & Northwestern.—Surveyed, end of '91 track to Wolf Creek, 16 miles. Ch. Engr., Geo. E. Muntz, Prescott.

Ravenden Springs & North Arkansas.—Located, Ravenden to Ravenden Springs, 9 miles. Pres, John B. Jones, Little Rock. Ch. Engr., P. L. Dougherty, Springfield, Nev.

Stuttgart & Arkansas River.—Partly graded, De Witt to Leslie Center, 20 miles. Ch. Engr., H. B. Carter, Clarendon.

Texarkana & Ft. Smith.—Partly graded, Ashdown, north 20 miles. Ch. Engr., J. E. Dougherty, Texarkana.

Total.—Under contract or construction, 98 miles. Surveyed or under survey, 181 miles. Projected, 25 miles.

Indian Territory.

Chicago, Rock Island & Pacific.—Under construction, Minco south, 18 miles. Under survey, end of grade to the Red River, 107 miles.

Choctaw Coal & Ry. Co.—Track laid since Jan. 1, 1892, end of '91 track to Oklahoma City, 12 miles. Surveyed, South McAlister to Oklahoma City, 89 miles.

Hutchinson & Southern.—Surveyed, Kansas state line to Pond Creek, 25 miles.

Total.—Under contract or construction, 30 miles. Surveyed or under survey, 221 miles.

Texas.

Austin & Northwestern.—Under construction, Fairland to Llano, 29 miles.

Bridgeport & Decatur.—Located, Decatur to Bridgeport, 12 miles. Pres., M. R. Lock; Ch. Engr., C. E. Moore; both of Decatur.

Ft. Worth & Rio Grande.—Projected, Brownwood to Brady, 44 miles. Ch. Engr., W. B. King, Ft. Worth.

Georgetown & Granger.—Track laid since Jan. 1, 1892, Granger to Georgetown, 15 miles.

Hearne & Brazos Valley.—Located, Mumford to Mosley's Ferry, 11 miles. Ch. Engr., W. S. Williams, Wanesburg.

Houston Belt & Magnolia Park.—Projected, extension to Harrisburg, 1.5 miles. Supt. S. B. Strong, Houston.

Missouri, Kansas & Texas.—Partly graded, Smithville to Lockhart, 36 miles; Boggy Lank to Sealey, 27 miles.

Pan-American.—Graded, Victoria south, 10 miles. Located, 10-mile post south 60 miles. Ch. Engr., Wm. H. Baker, Victoria.

Red River & Southwestern.—Partly graded, Henrietta to Archer City, 30 miles.

Rusk, New Birmingham & Dallas.—Projected, Rusk to Palestine, 30 miles. Pres., E. C. Dickinson; Ch. Engr., J. H. Barnes; both of Rusk.

South Galveston & Gulf Shore.—Projected, Galveston to South Galveston, 20 miles. Pres., M. F. Mott, Galveston.

Texas, Louisiana & Eastern.—Partly graded, end of '91 track to Ironwood, 32 miles.

Trinity, Cameron & Western.—Surveyed, Trinity to Granger, 113 miles. Pres., J. F. Hefley; Secy, M. J. Moore, both of Trinity.

Velasco Terminal.—Track laid since Jan. 1, 1892, 6 miles north of Velasco to Chenango, 14 miles. Projected, Velasco to Surfside, 3.5 miles.

Total.—Under construction, 193 miles. Surveyed or under survey, 196 miles. Projected, 99 miles.

Colorado.

Burlington & Missouri River.—Surveyed, Barr Station to Carlsbad Springs, 4 miles. Projected, Greeley to Idaho Creek, 16 miles.

Denver & Rio Grande.—Surveyed, Texas Creek to West Cliff, 25 miles.

Denver, Apex & Western.—Surveyed, Denver to Idaho Springs, 40 miles. Pres., H. A. W. Tabor, Denver.

Denver, Lakewood & Golden.—Under construction, Golden to Ralston Creek, 8 miles. Surveyed, Golden to Lookout Mt., 10 miles.

Pueblo, Wet Mt. Valley & Western.—Surveyed, Pueblo to Silver City, 71 miles. Pres., J. C. Teller, Denver.

Total.—Under contract or construction, 8 miles. Surveyed or under survey, 150 miles. Projected, 16 miles.

New Mexico.

Atchison, Topeka & Santa Fe.—Under way, Cerillos to San Pedro, 20 miles.

Santa Fe Southern.—Surveyed, Santa Fe to San Pedro, 49 miles.

Silver City, Pinos Altos & Mongallon.—Located, Silver City to Pinos Altos, 7.5 miles.

Total.—Surveyed or under survey, 76 miles.

NORTHWESTERN.

Iowa.

Chicago, Ft. Madison & Des Moines.—Surveyed, Libertyville to Ottumwa, 25 miles.

Winona & Southwestern.—Projected, Osage to Mason City, 20 miles.

Total.—Surveyed or under survey, 25 miles. Projected, 20 miles.

Minnesota.

Cloquet Lumber Co.—Projected, Duluth & Winnipeg R. R., north 10 miles.

Duluth & Iron Range.—Under survey, Mesabi west, 10 miles.

Duluth & Winnipeg.—Under construction, end of '91 track to St. Louis River, 2 miles. Projected, Grand Rapids west 25 miles.

Duluth, Mesabi & Northern.—Under contract, Duluth to Sec. 3, T. 58, R. 18 W., 100 miles. Pres., K. D. Chase, Faribault. Ch. Engr., C. H. Mantz, Duluth.

Duluth, Red Wing & Southern.—Graded, Alloues Bay south, 6 miles. Projected, between West Superior, Wis., and Red Wing, 144 miles. Ch. Engr., Wm. Danforth, Red Wing, Minn.

Duluth Transfer.—Surveyed, Duluth to West Duluth, 7 miles. Sec., A. H. Simmonds, Duluth.

Great Northern.—Projected, Park Rapids to Leech Lake, 19 miles.

Mankato & Northeastern.—Under survey, Mankato to Farmington, 50 miles. Pres., P. H. Carney; Ch. Engr., F. Woodbury; both of Mankato.

Total.—Under contract or construction, 102 miles. Surveyed or under survey, 67 miles. Projected, 54 miles.

Nebraska.

Burlington & Missouri River.—Track laid since Jan. 1, 1892, end of '91 track to Weuneta, 23.5 miles.

Kearney & Black Hills.—Projected, Calloway to Gandy, 30 miles.

Sioux City & Northwestern.—Located, Sioux City, Ia., to Niobrara, 80 miles. Ch. Engr., L. F. Wakefield, Sioux City, Ia.

Yankton, Norfolk & Southwestern.—Surveyed, Yankton, S. Dak., to Norfolk, 70 miles.

Total.—Under contract or construction, 24 miles. Surveyed or under survey, 150 miles. Projected, 30 miles.

North Dakota.

Minneapolis, St. Paul & Sault Ste. Marie.—Located, Merricourt to Aberdeen-Bismarck Branch, 30 miles. Projected, Valley City northwest, 25 miles.

Total.—Surveyed or under survey, 30 miles. Projected, 25 miles.

South Dakota.

Burlington & Missouri River.—Under construction, Deadwood to Spearfish, 16 miles. Surveyed, Englewood to Bald Mt., 5 miles.

Dakota, Wyoming & Missouri.—Under construction, Rapid City to Mystic, 32 miles. Pres., Wm. T. Coad; Ch. Engr., F. S. Broughton; both of Rapid City.

Duluth, Pierre & Black Hills.—Partly graded Aberdeen to Pierre, 123 miles. Ch. Engr., B. P. Tilden, Aberdeen.

Fremont, Elkhorn & Missouri.—Under construction, Deadwood to Spearfish, 16 miles.

Rapid City, Missouri River & St. Paul.—Partly graded, Rapid City to Cheyenne River, 40 miles. Pres., Rich. A. Lake; Ch. Eng., Myron Willsie; both of Rapid City.

Sioux City, Madison & Northern.—Projected, Garretson to Madison, 40 miles. Pres., Chas. B. Kennedy, Madison.

Total.—Under contract or construction 227 miles. Surveyed or under survey, 8 miles. Projected, 40 miles.

Wyoming.

Burlington, Missouri River.—Under construction, Gillette northwest, 50 miles.

Total.—Under construction, 50 miles.

Montana.

Butte, Anaconda & Pacific.—Surveyed, Butte to Anaconda, 20 miles. Ch. Engr., Jas. MacFarlane, Butte.

Great Northern.—Under construction, branch to Anaconda mines, 6.5 miles; Kalispell to Chattaroy, Wash., 200 miles.

Helena & Castle.—Projected, Helena to Castle, 115 miles.

Valley.—Located, Helena to Harlow, 13 miles. Pres., Rich. A. Harlow; Ch. Eng., W. A. Haven; both of Helena.

Total.—Under contract or construction, 106 miles. Surveyed or under survey, 33 miles. Projected, 915 miles.

PACIFIC.

Washington.

Arlington & Monte Christo.—Surveyed, Arlington to Monte Christo mines, 75 miles. F. W. Woolmans, Arlington.

Bellingham Bay & Eastern.—Under construction, New Whatcom to Lake Whatcom, 6 miles. Prest., Edw. Eldridge; Ch. Engr., J. J. Donovan; both of Fairhaven.

Drayton Harbor, Lynden & Spokane.—Located, Drayton to Lynden, 15 miles. C. T. Moore, Drayton.

Ellensburg & Northeastern.—Surveyed, Ellensburg to Port Eaton, 40 miles. Pres., John A. Shandy; Ch. Engr., H. E. Ward; both of Ellensburg.

Great Northern.—Under contract, Everett to Chattaroy, 296 miles.

Northern Pacific.—Partly graded, Gould to Niblock's, 10.2 miles. Under construction, Pe Ell to South Bend, 36.5 miles. Projected, Centralia to Cowlitz, 15 miles.

Port Angeles Southern.—Under survey, Port Angeles to Junction City, 35 miles. Pres., F. S. De Wolfe, Seattle. Secy., C. E. Mallette, Port Angeles.

Port Townsend Southern.—Projected, Quilicene to Butler's Cove, 60 miles.

Puget Sound & Pacific Ocean.—Surveyed, near Shelton to the Northern Pacific R. R., 12 miles; Shelton to Isabella Lake, 2 miles.

Snohomish, Skykomish & Spokane.—Under construction, Lowell to Port Gardiner, 4.75 miles. Ch. Engr., J. J. Folstad, Snohomish.

Tacoma & Seattle Air Line.—Surveyed, Tacoma to Seattle, 35 miles. Ch. Engr., G. W. Chapman, Seattle.

Union Pacific.—Partly graded, Portland to Seattle, 185 miles.

Vancouver, Klickitat & Yakima.—Projected, end of track northeast, 10 miles.

Total.—Under contract or construction, 588 miles. Surveyed or under survey, 214 miles. Projected, 85 miles.

Idaho.

Northern Pacific.—Partly graded, Nez Perces to Tammany, 31.3 miles.

Total.—Under contract or construction, 71 miles.

Oregon.

Astoria & South Coast.—Partly graded, Clatsop Beach, south, 7.5 miles; Hillsboro, north, 7.5 miles. Surveyed, between Clatsop and Hillsboro, 71 miles.

Columbia River & Astoria.—Surveyed, Astoria to Goble, 60 miles. Pres., J. H. Smith; Ch. Engr., W. H. Kennedy; both of Portland.

Coos Bay, Roseburg & Eastern.—Graded, Dunham to Coquile City, 10 miles. Surveyed, Coquile City to Roseburg, 77 miles. Secy., W. E. Baines, Marshfield.

Mt. Tabor & Eastern.—Projected, Portland east, 25 miles. J. T. Ross, Portland.

Rogue River Valley.—Projected, Medford northeast, 17 miles. Ch. Engr., J. S. Howard, Medford.

Siuslaw & Eastern.—Located, Siuslaw Harbor to Eugene, 50 miles. Pres., Geo. H. Ellesbury; Ch. Engr., T. R. Berry, both of Eugene.

Total.—Under contract or construction, 25 miles. Surveyed or under survey, 258 miles. Projected, 42 miles.

California.

California & Nevada.—Located, Bryant to Walnut Creek, 12.5 miles.

Los Angeles Terminal.—Surveyed, Los Angeles to Hueneme, 60 miles. Ch. Engr., W. F. McClure, Los Angeles.

Nevada California-Oregon.—Located, Amedee to Madaline Plain, 44 miles. Erasmus Gest, Reno, Nev.

San Francisco & North Pacific.—Projected, 2.16 miles west of Guerneville west, 3 miles.

San Joaquin Valley.—Projected, Pollasky to timber belt, 45 miles. Ch. Engr., O. T. Brown, Fresno.

Southern Pacific.—Tracklaying in progress, end of '91 track to Redlands, 5.5 miles. Under construction, Santa Margaerita south, 17 miles. Surveyed, 17-mile post to Ellwood, 5½ miles.

Total.—Under contract or construction, 23 miles. Surveyed or under survey, 174 miles. Projected, 48 miles.

Arizona.

Atlantic & Pacific.—Under construction, Phœnix to Ash Fork, 130 miles.

Utah.

Rio Grande Western.—Surveyed, Pricello Pittsburg, 50 miles. Projected, Salina to Maryville, 55 miles.

Union Pacific.—Partly graded, Milford to Pioche, 73 miles.

Utah & Wyoming.—Located, Salt Lake City, east to Kimballs, 24 miles. Pres., B. G. Raybould; Ch. Engr. John B. Taylor; both of Salt Lake City.

Utah Central.—Surveyed, Park City to Provo River, 25 miles; Park City to Weber Canyon, 20 miles; Park City to Hebel City, 8 miles.

Total.—Under contract or construction, 73 miles. Surveyed or under survey, 127 miles. Projected, 55 miles.

Nevada.

(See Union Pacific in Utah.)

Total.—Partly graded, 67 miles.

CANADA.

Ontario & Eastern Provinces.

Bay of Quinte.—Surveyed, Tweed, Ont., north 25 miles; Harrowsmith to Sydenham, Ont., 4 miles.

Brockville, Westport & Sault Ste. Marie.—Projected, Westport to Palmer Rapids, Ont., 80 miles.

Grand Trunk.—Surveyed, at Perkinsfield, 4 miles.

Great Eastern.—Partly graded, St. Francis to Nicolet, P. Q., 17 miles.

Lake Erie, Essex & Detroit River.—Surveyed Leamington to Ridgetown, Ont., 45 miles.

Montreal & Ottawa.—Surveyed, Rigaud to Ottawa, Ont., 75 miles. Ch. Engr., J. M. Stanley, Hudson, Ont.

New Glasgow Coal & Iron.—Surveyed, Glasgow, N. S., to mines in Pictou Co., 10 miles.

Nova Scotia Midland.—Partly graded, New Glasgow, N. S., to Atlantic coast, 60 miles. Pres., Herbert Redmond, 52 Broadway, New York City.

Orford, Mt.—Projected, Lawrenceville to Kingsey, P. Q., 30 miles.

Ottawa & Gatineau.—Partly graded, Lowe, Ont., north, 25 miles.

Parry Sound Colonization.—Located, 30 miles west of Scotia, Ont., to Parry Sound, 28 miles. Ch. Engr., S. R. Poulin, Emsdale, Ont.

Quebec Central.—Surveyed, Tring station to Lake Megantic, P. Q., 58 miles.

Stewiacke Valley & Lansdown.—Located, Middle Stewiacke to Lansdown, N. S., 27 miles.

Total.—Under contract or construction, 102 miles. Surveyed or under survey, 276 miles. Projected, 110 miles.

Manitoba and Northwest Territory.

Canadian Pacific.—Under construction, 55 miles southwest of Hartney, Man., to the Souris coal fields, N. W. T., 25 miles. Under contract, Mosquito Creek to Ft. McLeod, N. W. T., 50 miles. Located, Delorane to Melita, Man., 25 miles.

Great Northwest Central.—Projected, end of track northwest, 50 miles.

Port Arthur, Duluth & Western.—Under construction, 58-mile post to Gunflint Lake, 27 miles.

Total.—Under contract or construction, 112 miles. Surveyed or under survey, 23 miles. Projected, 50 miles.

British Columbia.

Canadian Pacific.—Surveyed, Revelstoke to Arrow Lake, 28 miles. Projected, Nelson to Spokane & Northern R. R., 50 miles.

Total.—Surveyed or under survey, 28 miles. Projected 50 miles.

MUNICIPAL GOVERNMENT IN LARGE CITIES.

(Concluded from page 195.)

Mr. E. B. Guthrie, deputy city engineer of Buffalo, N. Y., gave the following synopsis of the new charter of that city:

The common council is composed of two bodies viz., the board of aldermen, consisting of 25 members, one elected from each ward, with a term of two years, and the board of councilmen, consisting of 9 members, elected by the city at large, with a term of three years. All action must originate in the board of aldermen, while the board of councilmen only approve thereof or return to the first board for further consideration.

The mayor is elected for three years. The city clerk is appointed annually by the common council. The comptroller and treasurer are each elected for three years. Five assessors are elected for five years, one annually. The corporation council is elected fort hree years. The mayor and two commissioners appointed by him for six years form the police board. The health commissioner is appointed by the Mayor for five years, and the board of health consists of the Mayor, health commissioner and president of the board of public works. Three fire commissioners are appointed by the Mayor for six years, no more than two to be of the same political party. Of the three commissioners of public works, with terms of three years, one is elected, two appointed by the Mayor, but both cannot be from the same political party. Fifteen park commissioners are appointed by the Mayor for six years, without salary. The superintendent of instruction is elected for three years. An overseer of the poor is elected for three years. Two judges of the municipal court are elected for six years.

The department of public works is under the entire charge of a board constituted as described above, and the department is subdivided into four bureaus, the officers and employees of which are appointed by the board of public works. The bureaus are as follows:

Bureau of engineering, having charge of the construction and repairs of sewers, pavement, bridges, docks and sidewalks, locating and grading streets. The chief officer of this bureau being the chief engineer.

Water bureau, having charge of the construction and maintenance of all work pertaining to the water-works. The chief officer of this bureau is the water superintendent. The water bureau, however, remains in charge of the present three water commissioners until Jan. 1, 1893, when their term expires.

Bureau of streets, having charge of the cleaning of streets, removal of garbage, keeping streets free of encroachments, cleaning sewers, inspection of gas and electric lights and conduits of all kind. The chief officer of this bureau is the street superintendent.

Bureau of building, having charge of the construction and repair of all buildings in the city. The chief officer of this bureau is the superintendent of public building, with three inspectors, who shall be practical building mechanics of not less than five years' experience.

The board of public works may recommend any work to the common council, with or without plans and specifications, and the common council may order the work done or may order plans and specifications furnished with or without estimates or bids from parties to do the same. The common council may order any work, with or without recommendation of the board of public works, but when so ordered a contract shall be made by the board, except when the latter is authorized to do the work itself. No work to be executed until provision is made for payment thereof. The board may, on the order of the common council, enter into contract for not exceeding five years for cleaning the streets. No extension of the water-works to be made except on the recommendation of the board.

All appointments and removals in the department of public works are made by the board, all below the heads of bureaus being subject to civil service rules, according to the present system.

Crosswalks, sidewalks, culverts, sewers, receivers, wharves, piers, canals, slips and paving are to be paid for by local assessment. City Hall, markets, bridges, reservoirs, wells and fountains to be paid for either by general or local assessment. Repairs of paved streets and public sewers to be made from the general fund, and such repairs to be made by the board without order of the common council, and the board shall employ labor and purchase materials therefor.

No expenditure of $500 or over to be made by the board without consent of the common council; for expenses in excess of this the board shall publish a notice twice a week for two weeks in the official and two other daily city papers inviting proposals, and then contract with the lowest responsible bidder.

When a street is to be paved, plans and specifications shall be prepared for each kind of pavement for laying which specifications have been filed with the board. The latter shall advertise for bids and report to the common council. After 30 days and within 60 days the common council shall determine which kind shall be used, and in case no majority petition for a special kind shall have been presented, the common council shall declare by notice its intention to order the street paved with any kind it may select.

When expense of paving exceeds $500, it shall not be ordered except (1) on a three-fourths vote of all members elected to the common council, and after publishing notice of intention three times a week for three weeks; (2) unless petitioned for by a majority of resident owners, representing at least two-fifths of all feet frontage. No work, except paving, which shall exceed $500 shall be ordered except by a two-third vote of common council.

Mr. H. D. Woods, C. E., read a paper upon the municipal government of Paris, France, of which the following is a liberal abstract:

The government of the city of Paris differs considerably from that of the other cities of France, from the fact of its being the capital and seat of the central government. For this reason it is more directly under the control of government officials, both in the management of its finances and police, as well as in that of its public works.

In a general way the country is divided into 37,000 "communes," as they are called, which are the units of government in France. Each commune is presided over by a "maire," who is appointed by the President of the republic, from out of the municipal council of the commune, which is elected by popular vote. This maire has one to three assistants (adjoints), who represent him when absent or in press of business. These offices are gratuitous.

The maire represents the executive power in the commune, he represents the law in all civil acts, performs all marriages and makes all certificates of births, deaths, &c. He is agent of the government for the execution of all measures issued from it, and is a delegate of the judical authorities for all measures for the maintenance of peace and order. At the same time he is the agent of the commune to look after all its interests, and he appoints certain officials.

The municipal council discusses all measures to be taken for the management of the communal properties and the carrying on of its administration. It passes all appropriations, ordinances, &c. The maire is president of the council. The members are elected for six years, renewed by halves. There are from 10 to 36 members, according to the population, plus one additional for each "adjoint."

Each of the 87 departments of France is governed by a "prefect" appointed by the President. He represents the central government, and has charge of all the interests of the department, which he controls through the sub-prefects. He is assisted by a council of prefecture, appointed by the government. Each year the prefect visits the different communes of the department, and makes a report on them to the minister of the interior. He has power to suspend a member of a municipal council, in certain cases.

The "Department of the Seine," in which Paris is situated, is the smallest of all the departments, and contains but two other cities, the sub-prefectures of St. Denis, and Sceaux. "The prefect of the Seine" is in reality the "maire" of the city of Paris, as the name is applied to the other cities of the state. The municipal council of Paris discusses the appropriations and votes on them, but it cannot by any vote stop the credits or appropriations for carrying out any public service that devolves on the city to provide for. The minister of the interior has the power to insert in the appropriation order any omission of this kind that may exist. The president of the council is elected by the members, and simply presides over its sessions. He has none of the duties of a maire to perform.

The city of Paris is divided into 20 "arrondissements," each of which has a maire with assistant, appointed by the prefect, who attend to all the civil acts of the arrondissement. Each arrondissement is divided into four "quartiers," which each elect one member to the municipal council. Each quartier has a "juge de paix," appointed by the government.

The prefect of the Seine, beside having to look after the interests of the department, has also to supervise the finances of the city, the municipal debt, taxes, elections, schools, public lands and edifices, municipal buildings, markets, cemeteries, highways, parks, water-works, sewers, bridges, navigation and harbors of the river, and the canals, the pawnbrokerage establishment, and the relief of the poor. Thus all the public works are under the general management of the prefect. All estimates and bills of settlement for work have to pass before him, as well as be presented to the municipal council.

All questions of public safety and order are under the management of the "prefect of police," who is appointed by the government. He has to look after the public health, keep civil order, repress all kinds of crimes and misdemeanors, and have a surveillance over all hotels, lodging houses, etc., also the testing of all weights and measures, look after public markets, slaughter houses, public vehicles, funerals, the fire department and the general sanitation. Within a few years some of this work has been turned over to the department of public works. The prefect of police has full control of the appropriation for his department, and the municipal council has only to pass it as a lump sum. The general government refunds to the city about one-third of this appropriation. He has under his orders some 8,000 policemen, 4,000 Republican guards (726 mounted), and 1,742 firemen, who for all purposes, except fires, are under the control of the minister of war. There are 70 "commissaries of police," located in the different sections of the city, who hear all complaints of citizens and try as far as possible to adjust their small differences and thus keep them out of the courts.

Paris is by law obliged to have all its public works carried on under the direction of the government engineers, "Corps des Ponts et Chaussees." The other cities may apply for the services of the government engineers, but Paris only is obliged to employ them. The present organization dates only from 1878. Previous to that time, since 1854, at which date the general organization was started, there were two distinct departments of water and sewer work, and that in charge of streets, parks, lights, conveyance, etc.

The Department of Public Works is divided into two sections: The interior service, which forms part of the offices of the administration of the prefecture, and the active service, which includes all outside work. The interior or inside work is subdivided as follows: First division, first bureau, general work; second bureau, water, canals and sewers. Second division (highways), first bureau, contracts, acquisitions, expropriations; second bureau, street lines, unhealthy houses; third bureau, streets, parks, lights. Third division (architect), first bureau, city buildings, etc.; second bureau, state and department buildings; third bureau, bookkeeping, control and verification. Fine arts, orders, competitions, expositions, public festivals, care and inventory of monuments and art objects, historical work.

Active service is subdivided as follows:

1. Direction of highways and parks.—Sub-director, having in charge the following divisions: Plan of the city, highways, supervisor of public carriages, parks and plantations, public ways, street cleaning, lighting, leases on the highways, tree planting on streets. Control of gas works and meter, one chief inspector.

2. Water department.—One inspector general (chief

engineer) having in charge canals and water supply, maintenance of conduits, distribution of water, pumping plants.

3. Sewer department.—One chief engineer as chief engineer. One inspector general as consulting engineer. Have in charge sanitation of dwellings, construction and cleaning the sewers, and sewerage irrigation.

4. Quarries.—One chief engineer, acting as inspector of quarries; one ordinary engineer, acting as special inspector.

5. Architecture.—Control and verification, one head controller, two sub-controllers; maintenance of municipal buildings, 12 architects, each having charge of a section of the city.

Once a week there is a meeting of the Council of Engineers, under the presidency of the Prefect of the Seine, to deliberate and advise on the works proposed by the different engineers and connected with the different departments. This council of engineers consists of the director of public works, the consulting engineers, the chief engineers of the city of Paris, the chief engineers of the department of the Seine, the chief engineer of the quarries, the chief engineer of the water-works and the chief engineer of the sewers. The division engineers attend the meetings to give any information that may be required in reference to their department. The section engineers attend when their presence may be required.

All important work, whether emanating from the department of public works, the municipal council, or from the state department, after being worked and planned out by the engineers, has to be approved by the council of ponts et chaussees (bridges and roads) before it can be executed.

The engineering force of the department is composed of two classes: Engineers and conductors of the ponts et chaussees, detached from the government employ and assigned to the Prefect of the Seine; (they are paid by the city at rates corresponding to their grade in the corps, plus a certain amount for expenses or residence, varying with their work); and municipal engineers, who are civil engineers not connected with the ponts et chaussees. Both classes are subjected to a tax for the pension fund of their respective corps.

According to the published rolls of the corps of ponts et chaussees in 1891 there was in the employ of the city of Paris: Two retired inspectors general, one active inspector-general, first class; two active inspectors-general, second class; three chief engineers of the first class; two chief engineers of the second class; three sub-engineers; eight ordinary engineers of the first class; one ordinary engineer of the second class; one ordinary engineer of the third class; 108 conductors, and three clerks of the corps P. & C.

Placed under the orders of the engineers are a force of 1,289 conductors, inspectors and foremen. Those taken from civil practice have to pass an examination corresponding to the one passed by the members of the same grade of the ponts et chaussees, and the foremen have to pass a second examination before they can be promoted to a higher grade.

The chief engineers and ordinary engineers receive, in addition to their pay, corresponding to their grade in the corps of P. & C., from $900 to $2,100 for residence expenses. Inspectors chosen from the corps of ponts et chaussees or municipal engineers are paid from $1,200 to $1,600 per annum. The sub-engineers are paid from $1,040 to $1,200 per annum; chief conductors of either class, $840 to $1,200 per annum; conductors of either class, $580 to $780 per annum; inspectors of either class, $340 to $520 per annum. In addition, the last two grades receive 20 cents per hour for extra time. When they act as head of the offices this is paid as a lump sum, and is fixed at from $240 to $360, according to the work. Assistant heads get in the same way $200 to $300 per annum. Also $12 to $16 per month where they are in charge of important constructive yards. Managers and stock-keepers also get extras of from $20 to $300.

COMPARATIVE EFFICENCY OF BRAKES IN RECENT TESTS.

In describing the Lehigh Valley brake tests in our last issue some comparison was made between the efficiency of the brakes in that test and in the Burlington tests made during the first week in February, and it was stated that the average efficiency recorded in the Lehigh Valley tests was about 2% less than in the tests at Burlington a fortnight previous. The detection of some small errors in the figures given for efficiency in the Burlington tests in our issue of Feb. 13 leads us to reprint these figures in correct form in the accompanying table:

Brake Efficiency, Burlington Tests, Feb. 3, 4 and 5, 1892.

(1). Stops on a level.

Triple valve.	Speed, miles, per hr.	State of rail.	Length of stop, ft.	P,C. efficiency of brake.
New York.....	15	Good	93	8.20
New York.....	26	Good	297	7.68
Westinghouse..	23	Bad	239.3	7.46
Westinghouse..	23	Snowy	232.5	8.19
Westinghouse..	24.5	... .	283.5	7.13
New York.....	31	Good	360	9.02
Westinghouse..	30	Bad	384.5	7.86
Westinghouse..	32	Snowy	388.5	8.94
Westinghouse..	31	Good	417	7.72

(2). Stops on 1% down grade.

New York.....	18	Good	156	7.96
Westinghouse..	19	Bad	162	8.51
Westinghouse..	22.5	Snowy	238.5	8.14
Westinghouse..	21	Good	190	8.83
New York.....	36	Good	574	8.53
Westinghouse..	36	Bad	646	7.65
Westinghouse..	33.5	Snowy	561	7.63

By these corrected figures the average efficiency of the brakes in the Lehigh Valley trials is found to be 1.77% less than in the Burlington trials.

The New York brake showed an average efficiency in the Burlington trials slightly in excess of that of the Westinghouse, 0.27% on the average. The rails at Burlington were in poor condition when the Westinghouse brake was tested. In the Lehigh Valley trials the corrected figures show the two brakes to have been almost equally efficient, being 6.31 for the New York and 6.32 for the Westinghouse. This result gives excellent evidence as to the substantial accuracy of the tests, as they were intended to be carried out with each brake under conditions as nearly identical as possible. The summary of average of efficiency is as follows:

	Average efficiency:	
Brake.	in Burl. tests.	in Lehigh Valley tests.
New York.....	8.28	6.31
Westinghouse.....	8.01	6.32
Av. for both brakes..	8.09	6.32

It may be well to explain here that the quantity which we have designated as the percentage of efficiency is the ratio of the mean retarding force to the total weight of train, or the per cent. of an up grade on which a train moving at the given speed would come to rest at the point at which a stop was obtained with the brakes, this grade beginning at the point where the engineer's valve is opened to apply the brakes. The method of computation of this quantity, with tables which facilitate the work, is given in "The Economic Theory of the Location of Railways," pp. 335, 337.

ADDITIONAL TESTS OF THE NEW YORK AIR BRAKE ON THE LEHIGH VALLEY R. R.

As noted in our last issue, the failure of the New York air brake to release properly in the tests on the Lehigh Valley R. R., Feb. 16 and 18, was ascribed by the makers to defects in the manufacture of the triple valve pistons due to the haste with which the triple valves were made in order to have them ready for the tests. Immediately following these tests the New York Air Brake Co. took steps to correct these defects, and on Thursday, Feb. 25, the 50-car train used in the former tests was equipped with a new set of triple valves and tested under the direction of Messrs. Jno. S. Lentz, Supt. Car Department, and J. I. Kinsey, Master Mechanic of the Lehigh Valley R. R. No representatives of the Westinghouse Brake Co. were present at the tests. The following record is furnished us by the New York Air Brake Co.:

Test 1. Standing test, 70 lbs. pressure in both train pipe and main reservoir (no excess pressure). Emergency application for 1 second; handle of engineer's valve then put in release position and train pipe pressure pumped to 70 lbs. All brakes released promptly. [Exact time not stated.]

Test 2. Same conditions. All brakes released promptly but one (the 26th car from engine).

Test 3. Same conditions. All brakes released promptly.

Test 4. Standing tests to show engineer the proper way to release a long train and make sure that any valves not recently cleaned would be certain to release. 70 lbs. pressure in both train pipe and main reservoir (no excess pressure). Emergency application was made for 1 second, and then handle of engineer's valve was put in the release position until 58 lbs. were in train pipe. Handle was then placed in running position until 20 lbs. excess pressure was in main reservoir, then put in release position again. All brakes released promptly.

Test 5. Same as Test 4, except with excess pressure before commencing test. Train pipe pressure, 70 lbs.; main reservoir pressure, 90 lbs. Emergency application for one second, and handle of engineer's valve then placed in release position until 58 lbs. was in train pipe. Handle was then placed in running position until 20 lbs. excess pressure was in main reservoir, then put in release position again. All brakes released promptly.

Test 6. To make service application and see how quickly brakes could be released and train got in motion (train standing on a curve), 70 lbs. train pipe pressure, and 95 lbs. in main reservoir; 10 lbs. reduction and handle of engineer's valve allowed to remain at lap position one-half minute to represent stop. Handle then placed in release position, and at the end of one-half minute train was backed. All brakes released promptly and entire train was in motion in eight seconds.

Test 7. Same as above test, train-pipe pressure being 69 lbs. and main reservoir pressure 94 lbs. All brakes released promptly, and entire train was in motion in 12 seconds.

Test 8. Same as Test 3, but emergency application. Engineer to blow whistle at the instant of moving handle to release position, handle allowed to remain in release position one minute before starting train. All brakes released promptly, and entire train was in motion in 1 min., 10 sec.

Note.—The Westinghouse standard 8-in. pump used in all of above tests.

Test 9. Same as above. Engineer to blow whistle at the instant of moving handle to release position, handle allowed to remain ½ minute in release position before starting train. All brakes released promptly, and entire train was in motion in 44 seconds.

Test 10. Same as above test. Engineer to blow whistle at the instant of moving handle to release position, handle allowed to remain 15 seconds in release position before starting train. All released, and entire train was in motion in 26 seconds.

Test 11. Same as above test. Engineer to blow whistle at the instant of moving handle to release position, handle allowed to remain 10 seconds in release position before starting train. All brakes released promptly, and entire train was in motion in 18 seconds.

Note.—It was noted that in all of these get-away tests it required 8 to 10 seconds from the time when the engine moved until last car moved. The New York Duplex pump was used during Tests 9, 10 and 11.

Test 12. Same as Test 7 of Westinghouse brake, Feb. 17. 70 lbs. train pipe pressure, and 105 lbs. in main reservoir. Emergency application, and all air let out of train pipe. Handle of engineer's valve then placed to running position and brakes pumped off through feed port. Both pumps used until 110 lbs. obtained in main reservoir, then N. Y. pump shut off. All brakes released promptly.

Test 13. Emergency application with three cars cut out (position not stated). Emergency action jumped the three cars and applied throughout the train.

The Westinghouse engineer's valve was used in all the tests. The records of release were taken as follows: A Lehigh Valley man and a New York Brake Co. man examined the front half of the train after each stop, and another Lehigh Valley man and another New York Brake Co. man examined the rear half of the train. The steam pressure during all the tests was 140 lbs. The brakes were operated by a Lehigh Valley engineer.

It will be noted that Test 12 was the only one in which it was attempted to release the brakes with the engineer's valve in the running position. The test for release made at Burlington with the engineer's valve in this position, which resulted in the sticking of 16 brakes having the New York triple valve, compared as follows with Test (12):

Data of test.	Burlington.	Lehigh Valley.
Length of train.....	25 cars.	50 cars.
Train-pipe pressure.....	70 lbs.	70 lbs.
Main reservoir pressure..	100 lbs.	105 lbs.
Emergency application was made letting:	Part of air out	All the air out.
After equalization brakes were pumped off by:	Westinghouse pumps.	Both West'h'e and N. Y. pumps used till 110 lbs. in main res., then N. Y. pumps shut off.

The results at Burlington with the New York brake were that 8 cars released in 25 to 90 seconds and 16 stuck, and were released by hand. In the Lehigh Valley test above reported, it is simply stated that "all brakes released promptly." It will be seen that the Lehigh Valley test, while differing in several particulars from that at Burlington, was on the whole much more severe, being made on a 50-car train instead of a 25-car train.

NOTES FROM RECENT WATER-WORKS REPORTS.

About 8% of the fixtures examined by the inspectors of the St. Louis water-works during the year 1890-1, or 17,156 out of 224,888, were found to be leaking or wasting water in other ways. The report for 1890-1 contains some very interesting views showing different parts of the low service extension, some completed and others under construction. Several of these views were reproduced in our issue of Feb. 20, and the settling basins and inlet tunnel and tower were fully illustrated and described in our issues of April 18 and July 4, 1891. Mr. M. L. Holman is Water Commissioner.

The effect of the tornado of March 27, 1890, on the water tower of the Louisville Water Co., is shown by photogravures in the company's report for 1890, issued a short time ago. One of the views shows the pumping station and water tower before the tornado, and the other two show the tower after it had been wrecked. A very interesting account of the tornado, as experienced in connection with the water-works, is given.

The statistical information in the above report is very complete; especially that relating to the consumption of water, a distinction being made between consumption per consumer, and per inhabitant, a point which was commented upon in an editorial note in our issue of Feb. 13, 1892. In 1861 the daily consumption per consumer was 73.6 gallons, and per inhabitant, 8.66 gallons. In 1889 the consumption per consumer was 89.22 gallons, and per inhabitant, 71.11 gallons.

In 1861 not quite 8%, and in 1889 not quite 80% of the population was supplied, the figures, estimated in each case, being 74,000 population and 5,280 supplied in 1861 and 167,000 population and 131,560 supplied in 1889. In 1861 the average daily amount of water supplied to each consumer was 73.6 gallons, and in 1889, 89.22 gallons. The greatest consumption was in 1880, 109.86 gallons, and the least in 1863, 55.02 gallons. Since 1884 the consumption has been reduced from 104.77 gallons, the figures for that year, to 89.22 in 1889, the reduction being continuous, but in 1887 taking a sudden drop to 77.96 gallons. In 1889, of 133,100 population within pipe limits, 131,560, or all but 2,460, less than 2%, were consumers. Regarding variations in consumption at Louisville, Mr. Chas. Hermany, Chief Engineer and Superintendent of the company, writes under date of Feb. 22, that such variations result from three principal causes, which he states as follows:

First. The difference in our summer seasons, some being excessively long, hot and dry, while others are correspondingly remarkable for an abundance of rainfall and comparatively cooler weather. Second. The variableness in our winter seasons from mild open weather to that of extreme cold, and, as a consequence, extraordinary wastefulness in the use of water to guard against freezing, inasmuch as people in this latitude do not prepare their cellars or basements as a general thing for cold weather Third. The great variation in the volume of water used by distillers, who during some seasons do not work at all, while in others they run from six to eight months and use a large volume of water.

The water-works at Pawtucket, R. I., are notable as claiming to have been the first in the country to furnish meters to consumers without charging a rental, and also as having some pumping engines which have shown a remarkable working duty. Dec. 1, 1891, there were 3,774 metered services in use, or about 67% of the total number of services. The average duty for the year of the 6,000,000-gallon Corliss pumping engine at station No. 3 was 118,189,013 ft. lbs. per 100 lbs. of coal, the duty being calculated on coal used for starting, pumping and banking, with no deduction for ashes or cinders. On the basis of all coal consumed, with no allowance for ashes or cinders, the duty was 113,940,800. The average head pumped against, with no allowance for friction in suction, was 280.92 ft. The total pumpage for the year, by this pump, was about 870,000 gallons. Edwin Darling is Superintendent.

Subsidence is recommended by Col. Geo. H. Elliott, Engineer in charge of the Washington Aqueduct, as a means of improving the water supply of Washington, D. C. All the city, excepting that under high service, is supplied by gravity, and there is not sufficient head for gravity filtration. Subsidence could be effected by improving the receiving reservoir, which has a capacity of 175,000,000 gallons, and has been out of use for some time.

Colonel Elliott is in charge of the Washington water-works outside of the distributing mains, including the masonry dam across the Potomac River, 2,877 ft. long, the aqueduct, receiving, low and high-service distributing reservoirs and supply mains connecting the latter with the distributing mains. The report for 1890-91 contains a map of the aqueduct and supply mains, several plats showing pipe junctions in the distributing system, a bridge for carrying a 48-in. main over Rock Creek (see Eng. News, Feb. 13, 1892, for one set of junctions and bridge) and tables showing consumption and waste of water and figures regarding available quantity and quality of water during the year.

The Massachusetts State Board of Health has advised the abandonment of the Taunton River as a source of supply for the city of Taunton and has approved the drawing of a new supply from the Lakeville Ponds. Several analyses of both the Taunton River and Lakeville Pond water, made by the State Board of Health, are given in report of the Taunton Water Commissioners for 1891. Superintendent Geo. F. Chace discusses the city's water supply at some length in the same report and there is included the results, which were favorable, of a 12-hours' duty trial of a 4,000,000-gallon Gaskill high duty pumping engine with contract duty of 100,000,000-ft. lbs.

The addition of a few meters and increased thoroughness of inspection reduced the consumption of water at Wilmington, Del., in 1891 by about 9%, or by 208,104,810 gallons, the total pumpage, excluding repumpage, for the year having been 2,325,208,776 gallons, or 98 gallons per capita per day. The report does not state the number of taps and meters in use, but at the close of 1890, according to the "Manual of American Water-Works," there were 12,238 taps and but 28 meters. In 1891 the inspectors found 1,147 leaks. Joseph A. Bond is Chief Engineer of the works.

Providence is one of the few large cities in the United States having over 50% of its taps metered, there being but three others among the 50 largest cities: Atlanta, Ga.; Worcester and Fall River, Mass. According to the last quarterly report of Robert E. Smith, Commissioner of Public Works, Providence had on Dec. 31, 1891, 9,972 meters in use against 15,723 service stops, or about 63% of its services metered. The status of the 50 largest cities in this respect, and of all smaller places having 20% or more of their taps metered, was set forth in detail in our issue of Jan. 16, 1892, most of the figures, however, being for 1890. The average daily consumption of water at Providence in 1891 was 7,272,070 gallons, but as an outside population is supplied the per capita consumption cannot be calculated, but it does not exceed 50 gallons per inhabitant we feel sure and is probably less. The effect of meters is evident.

THE STRENGTH OF M. C. B. COUPLERS.

At the last meeting of the Western Railway Club the following paper was read by Mr. Wm. Forsyth, Mechanical Engineer of the Chicago, Burlington & Quincy R. R.:

The introduction of the Master Car Builders' form of car coupler on the railroads of the United States is now so general and extensive that it must be regarded as a well established standard, which will be maintained in increasing numbers for years to come. The statistical report of the Interstate Commission shows that there were in the United States on June 30, 1890 114,364 cars equipped with M. C. B. couplers, and on June 30, 1889, 80,510 cars equipped with M. C. B. couplers. This is an increase in one year of 33,854 cars.

It is quite probable that in the year 1891 over 50,000 cars were equipped with this coupler and a larger number put on in 1892, so that by the end of the present statistical year nearly 20% of all freight cars in service will be equipped with automatic couplers—a more rapid increase in the use of a new standard than has ever been known in the history of car building in this country.

The records for breakage of the M. C. B. couplers, kept for two years on the Chicago, Burlington & Quincy R. R. from October, 1889, to October, 1891, show that 7% of the couplers break annually; and of these 37% break in the arms; 24% of the knuckles break annually, 50% of them through the upper lugs. This is based on 1,184 cars equipped with M. C. B. couplers in 1889, and 9,205 cars in 1891. In the year 1891 we had replaced by one company 540 broken couplers and 2,400 broken knuckles.

It seems to be taken for granted that a large number of M. C. B. couplers must break, and that we should accept this condition of things as inevitable. One coupler company advertises the fact in a very prominent manner that in one year, out of 10,000 couplers in service, 400 bars and 1,445 knuckles were broken; while another company broke nearly seven times as many bars and four times as many knuckles. This cannot be regarded as a satisfactory record for a newly established standard. We do not have so many failures of any other railroad material as to lead us to require manufacturers to replace all broken pieces.

It may be said that in spite of these frequent failures the bar is economically an improvement over the link-and-pin bar, because makers replace broken parts at small cost, and the cost of maintenance per year for material is now lower than when links were generally used. But the cost of draw-bar material is a small part of the expense to railroads caused by trains breaking in two. It is a frequent cause of bad wrecks, in which both car bodies and trucks are damaged, the train is delayed and also the trains immediately following it.

Much of the damage to automatic couplers is due to the links in plain couplers striking them in switching, and this destruction will continue to increase until over 50% of all cars are equipped with the new bar. Another cause of increasing fatality to the M. C. B. bar and knuckle is the reckless and improper use of the quick-acting emergency brake. The air brake as now used cannot be said to be entirely advantageous. The recent tests at Burlington with the most perfect brakes now made, on a train entirely equipped with the M. C. B. couplers, were seriously interrupted and delayed by the breakage of knuckles and bars. An illustration was also then given of the effect of the emergency brake when a regular train broke in two and the front car was thrown against the engine, knocked off the truck, and its end sill and draft rigging were destroyed.

There have been recently introduced in the House of Representatives four bills which in effect compel railroads to equip their cars with safety appliances, air brakes and automatic couplers, and it is quite probable that an act of this character will soon be passed. The demand for cheap couplers which is sure to follow will place on the market bars made of poor material and unfit for the purpose. The M. C. B. Association has already taken measures to devise rules for the inspection of air brakes before purchase, and the necessity of similar action for couplers is now apparent.

For nearly all iron and steel products used in such large quantities, railroad companies have in recent years formulated specifications and tests to be used in inspecting material, so that they may be reasonably certain that they are getting supplies of proper size and strength for the service required of them. Thus we have specifications for car axles, bar iron, steel for locomotive boilers, parallel rods, etc. For a detail which should be uniform in size and possess great resistance it has seemed to me that the M. C. B. coupler should be bought subject to inspection and tests.

I will not take up inspection by gages, but will endeavor to present a preliminary study of that part of the proposed specification which relates to the strength of the coupler, considering first the strength of design, and, second, the strength of material.

First.—The car coupler as now generally used performs two functions: It acts as a convenient mechanism for connecting one car with another and as a buffer for resisting the shock when they come together. The M. C. B. form was selected as the most practical one for automatically performing the first function; but the experiments to determine the correctness of the designs when used as a buffer were not made under conditions as severe as subsequent service imposed, or I am sure the form would have been modified to a more natural one for resisting violent compressive blows. Any one designing a battering ram would not make it in the form of the letter U, with one leg presented sideways to receive the blow.

The cast-iron link coupler developed into a form known as a bull-nose, a name which carries with it the idea of butting rather than coupling. In it a large mass of material surrounded the small opening of the link. The prominent feature of the design was that of a ram, the provision for the link seeming almost incidental. Notwithstanding this strength of the design, the link coupler breaks more frequently than any other casting in a car, and this fact should have pointed out the necessity of great strength in any new design which was to take its place.

Buffer blocks at each side of a link coupler, though not a desirable thing for the safety of trainmen, are a great protection to the coupler. This is shown by the fact that where they are used it has been found possible to make a wrought iron draw-bar, suitable for link connections, which does not break often and which weighs not more than from 60 to 75 lbs.

The advantage of buffers is so great that they are largely used with link couplers, notwithstanding the danger to the men who have to go between the cars to adjust the link and pin. With automatic couplers, where this danger to the men is removed, it is strange that the protecting buffers have also disappeared. When the coupler became an organized structure with its weak points in bar and knuckle and pin, it then needed more than ever the protection of the buffer, so that its function should be only that of a coupler, and not that of a combined coupler and buffer.

I have for several years advocated the use of spring buffers in connection with the M. C. B. coupler, but a practical device for the purpose has not yet been introduced, and it will be necessary to make a start in this direction and demonstrate their real economy notwithstanding the extra cost. I am aware that the buffers would be useless if cars came together with knuckles closed, and couplers should be arranged so that when unlocked the knuckle will always stand open. Several coupler companies now claim to accomplish this, but they are not uniformly successful; we must accept for the present the general practice as it now is, which compels couplers to act both as couplers and buffers. The necessity of this duplex quality seems so important in the minds of some, that one of the bills before Congress already referred to (the Milliken bill), has a provision which requires that the "standard coupler must act as its own buffer."

Second.—Having discussed the shape of the coupler in its relation to frequent breakages, I will now take up the resistance of the M. C. B. couplers to tensile and compression stresses. Some couplers are admittedly weak in both directions, and a specification for M. C. B. couplers should provide for tests which will measure the pulling resistance, as well as to blows delivered somewhat like that when two cars are thrown in violent contact.

To get necessary data for such a specification it is necessary to test couplers of various makes in each way, and see what is the maximum that may be expected. In conducting such tests at Aurora we have two pieces of testing apparatus adequate for the heavy work required; a Riehle testing machine, made for testing large bridge rods having a capacity of 200,000 lbs., and an axle testing machine having a drop-weight of 1,640 lbs. with a maximum fall of 30 ft. We have already made a number of tests of M. C. B. couplers on these machines, and I will give some of the results.

In the tensile machine two couplers of the same kind were pulled against each other, and Tables I. and II. give the results of a few of these tests.

Table I.—Tensile Strength of Malleable Couplers.

Date.	Type.	Ultimate strength, lbs.	Location of fracture.
1888	A	80,000	In bar at bottom lug.
1888	A	89,600	In wrought-iron knuckle tongue 2 ins. from end.
1889	B	102,000	In bar at lug.
1891	B	112,000	In bar at lug.
1892	C	90,000	In steel knuckle.
1892	E	121,100	In steel knuckle.

Note.—The average of six malleable bars, including four different kinds, was less than 100,000 lbs., and one-half of the bars were broken.

Table II.—Tensile Strength of Steel Couplers.

Date.	Type.	Ultimate strength, lbs.	Location of fracture.
1892	F	105,000	Knuckle broken.
1891	H	148,800	Knuckle broken.
1892	D	98,200	Knuckle broken.
1892	I	122,400	Knuckle broken.
1892	I	108,100	Knuckle broken.

Drop Test for M. C. B. Couplers.

Note.—The average strength was 116,300 lbs. None of the steel bars were broken, but all failed in the knuckles.

The strength of the material in wrought-iron knuckles is not as great as the strength of the bar iron from which they are formed. Broken knuckles of this kind are invariably coarsely crystalline. I had a tensile test piece made out of one of these knuckles and found the ultimate strength to be 8,800 lbs.; elastic limit, 27,300 lbs.; elongation, 15% in 2 ins.

In Tables III. and IV. are given the results of drop tests, in which the weight of 1,640 lbs. struck the knuckle in the manner indicated in the cut. Iron axles, 4½ ins. diameter at the center, must stand 3 blows from 10 ft., and 2 at 15 ft., from a weight of 1,640 lbs., with supports 3 ft. apart from center to center.

Table III.—Drop Tests of Malleable Couplers with Wrought-Iron Knuckles.

Date.	Type.	Blows and Results.
1891	1. A	Three blows, 10 ft.—One at 15 ft. bent barrel 1½ ins. out of line; lower lug of knuckle cracked.
1891	2. A	Three blows, 10 ft.—Lower lug of coupler cracked through pin hole.
1891	3. A	Three blows, 10 ft., five blows, 15 ft.—Arm broken by weight glancing from knuckle.
1891	4. A	Three blows, 10 ft., one at 15 ft.—Lower lug of knuckle cracked.
1891	5. A	Three blows, 10 ft., one at 15 ft.—Upper knuckle lug cracked.
1891	6. A	Two blows, 10 ft.—Upper knuckle lug cracked.
1891	7. A	Three blows, 15 ft.—Cracked coupler arm, knuckle opening reduced from 3 1/16 ins. to 2⅝ ins., stem broken and back cracked.
1891	8. A	Weight striking arm only; two blows, 10 ft.—Arm broken off.
1891	9. B	Three blows, 10 ft.—Both lugs and most of back broken.
1891	10. C	One blow, 10 ft.—Broke tongue of steel knuckle.
1891	11. E	Two blows, 10 ft.—Cracked steel knuckle; third blow, 10 ft., and one at 15 ft.—Broke knuckle.

Table IV.—Drop Tests of Steel Couplers with Steel Knuckles.

Date.	Type.	Blows and Results.
1892	12. F	One blow, 10 ft.—Broke bar back of knuckle.
1892	13. I	Two blows, 10 ft.—Broke knuckle at pivot pin hole.
1892	14. D	Three blows, 10 ft., two blows, 15 ft.—Broke in tongue of knuckle just above pin hole.

These drop tests show a wide variation in the strength in the different type of couplers, one kind breaking under the first blow from 10 ft., while others endure the full test for iron axles 4¼ ins. diameter. The fractures show, also not only the weak points in the design, but the poor quality of the material in both malleable iron and cast steel couplers. The steel bars were evidently made of a grade of steel not suitable for the purpose, and the castings had not been properly annealed. Tensile test pieces made from the same cast as Coupler I had a strength of only 42,000 and 49,000 lbs. per sq. in., and elongation of 1% and 2% in only 8 ins.

A test of a specimen from another coupler shows that the material is much better adapted to the requirements. It is as follows:

	Not annealed.	Annealed.
Elastic limit, lbs. per sq. in.	48,000	43,800
Breaking strain " "	64,000	61,000
Elongation, % in 4 ins.	8.25	12.5
Reduction of area, %	11.1	21.3

I have already said enough to show that the M. C. B. coupler as now made is a weak one, both in design and material, and as we cannot change the shape to a strong form without interfering with the standard lines and destroying interchangeability, the only thing that can be done is to make the bar and knuckle of the strongest material possible. The form also requires the coupler to be cast, so the only choice lies between malleable iron and cast steel.

Malleable Iron.—The report on the use of malleable iron in car construction read at the last M. C. B. Convention takes up the question as to whether malleable iron is the best material for M. C. B. couplers, and gives a table showing the strength of thick and thin malleable cast iron specimens. [Report and table published in Eng. News, June 13, 1891.]

The table showed a strength of 25,000 to 35,000 lbs. per sq. in., and an elongation of 1% to 2% in 4 ins.

Quite recently the National Malleable Casting Co. have had made an investigation of the strength of malleable iron castings by D. L. Barnes, Consulting Engineer. The samples submitted for test were from 2.63 ins. to 3 ins. wide and 0.247 ins. to 1.03 ins. thick. The average ultimate strength of 8 samples with skin unbroken was 27,870 lbs. per sq. in.; 12 pieces with edges dressed averaged 27,786 lbs., and 5 pieces dressed on all sides averaged 25,560 lbs. The elongation of the test piece was so small that it was not measured. The internal structure of the broken test pieces showed a want of homogeneity.

These bars, especially prepared for tests, and representing doubtless the best that can be done in malleable castings, show as an average of 25 specimens a tensile strength less than 28,000 lbs. per sq. in. and practically no elongation.

Measured by such figures, we must conclude that malleable iron does not possess sufficient strength and ductility to make it the best material for the severe service of the M. C. B. coupler.

Steel castings.—Steel castings, when properly made, possess a strength greater than wrought iron, and a ductility nearly equal to it. The irregular character of many steel castings made heretofore has given them a bad reputation; but the sound part of a steel casting is so superior in strength and ductility to any other kind of casting that the best efforts of our metallurgists have been directed to the problem of the production of sound steel castings, and as a result the quality of such castings is gradually improving. I believe that finally the process will be so improved, molds and foundry manipulations so well understood, and the workmen so skilfully educated, that absolute reliance can be placed on the product.

The tensile resistance of the couplers tested did not show the superior strength to be expected from this material, but when properly made I believe there is a better prospect of getting strong couplers, made of a material which in repeated tests has shown a strength of 60,000 to 70,000 lbs., and an elongation of 15% to 20% in 8 ins., than from one which will not average over 30,000 lbs. with practically no elongation.

In making a specification for testing M. C. B. couplers I should place the figures for tensile strength of the material about as high as any bar has been found to endure, for I think the competition among coupler makers will soon result in the production of a stronger bar than they are now making, if the stronger bar is demanded by the railroad companies. I would require them to endure a pulling load of 125,000 lbs., and in time this could probably be raised to 150,000 lbs. For the drop test I would require the same kind and number of blows as are given M. C. B. 40,000-lb. iron axles, two couplers out of each 200 to be tested in the tensile machine, and the one remaining unbroken to be tested under the drop.

Proposed Specifications for Strength of M. C. B. Couplers.—Two sample couplers, selected from each lot of 200, when tested for tensile resistance, must not break under a load of 125,000 lbs.

The coupler remaining sound must endure a drop test of 1,640 lbs.—three blows falling 10 ft. and two blows falling 15 ft., the die striking the knuckle, as shown in the figure above; the tail of bar to rest on a solid block of iron weighing not less than 500 lbs.

A test bar made from the same cast as the coupler, or cut from a coupler, must have a tensile strength of 60,000 to 70,000 lbs., and an elongation of 15 to 20% in 4 ins., or 10 to 15% in 8 ins.

COST OF STREET PAVING.

Mr. Harvey Linton, City Engineer of Altoona, Pa., has prepared a table of the paving completed during the years 1888–1891, showing a total of 4,106,593 sq. yds., equal to 6 miles 298 ft. of roadway 30 ft. wide. The prices range as follows:

Sheet asphalt	$2.50, $2.90 and $3 per sq. yd.
Asphalt block on concrete	$2.50 and $3.42 " "
" " on stone	$2.50 and $2.55 " "
Stone block on concrete or stone	$3.40 " "
Vitrified brick on concrete	$3.10 " "
" " on broken stone	$2.23 " "
Cobble	$1.00 and $1.25 " "

The manufacturing interests of the District of Columbia, as shown by Census Bulletin No. 158, have risen from $11,882,000 in 1880 to $39,236,000 in 1890. The wages paid have risen from 3.9 to 14.6 millions, of which 3.8 millions were paid out in government shops and factories. Carpentry and plumbing and gas fitting, however, account for 4.25 millions of wages.

Another St. Clair tunnel, according to a Port Huron item, is to be built by the Grand Trunk Ry. Co., adjacent to the one lately opened. The land is already secured, and the same item says that work is to be commenced within 60 days.

The New Argentine railway, to the eastern foot of the Andes, is said to have upon it a tangent 211 miles long, over the pampas country. On this tangent there is not a bridge or opening larger than an ordinary drain, nor a cut or fill much over 3 ft. in depth or height.

Work on the State Geological Survey of Washington has been indefinitely postponed.

The deep water harbor at Tampico, Mex., which has been completed at a cost of $3,500,000, has proved successful. Two rock piers 1,000 ft. apart were built out parallel into the sea 7,000 ft. at the mouth of the Penuca River. This removed the bar and left an open channel 18 ft. deep from the sea to the landing at Tampico, seven miles in the interior.

The overhead electric wire ordinance, passed by the City Councils of Philadelphia, has been vetoed by the Mayor. This ordinance authorized the almost indiscriminate erection of poles and overhead wires for lighting and traction purposes. The Councils seem inclined to pass the ordinance over the Mayor's veto, according to rumor, under the dominating influence of the Electric Light Trust in that city.

CONSTRUCTION NEWS.

RAILWAYS.

East of Chicago.—Existing Roads.

NEW YORK, LAKE ERIE & WESTERN.—This company will operate the line of railway now nearly completed from Salem to Washingtonville, O., 7 miles. It will be put in operation in about a week.

PITTSBURG, OHIO VALLEY & CINCINNATI.—The grading is completed on the line from Bellaire to Powhatan, O. Work is now in progress on some of the bridges and culverts. It is expected to have these finished in about a month.

HUMMELSTOWN & BROWNSTONE.—This road will, it is stated, be extended to a connection with the Pennsylvania R. R. at Middletown, Pa.

PHILADELPHIA & READING.—The Philadelphia & Newtown Connecting R. R. Co. has been chartered in Pennsylvania in the interest of this company to build a railway from the Tabor Branch to a point on the Philadelphia, Newtown & New York R. R.—Surveys are reported in progress along the bed of the old Union Canal running from Reading, Pa., west into Dauphin Co., and it is reported that a line will be built to Bernville, 13 miles from Reading.

BALTIMORE & OHIO.—Grading is about completed on the line from Fairchance, Pa., to Smithfield, Pa. Work south of Smithfield has been discontinued pending some changes in the proposed route.

LEHIGH VALLEY.—Work is making rapid progress upon the second track between Geneva and Buffalo, N. Y., and it is expected to have the road opened for regular traffic by the middle of May. The contract by which the company's trains run over the New York, Lake Erie & Western tracks will expire on May 1.

PORTLAND & RUMFORD FALLS.—The stockholders of this company have authorized a consolidated mortgage of $450,000 to provide for paying off the indebtedness of the old company and the construction and equipment of the extension to Rumford Falls, Me.

PITTSBURG, AKRON & WESTERN.—The Akron & Eastern Ry. Co. has been chartered in Ohio to build a railway from Akron, O., to New Castle, Pa., about 70 miles. The road is projected to give an eastern connection to the Pittsburg, Akron & Western R. R., and has been talked of for some months. It is stated that the section from Akron to Mogadore, O., about 6 miles, will be put under contract at once.

Projects and Surveys.

LONG ISLAND & NEW YORK TERMINAL.—This company has been chartered in New York to build a railway from Laurel Hill, in Queen's Co., on Long Island, to Park Ave., between 33d and 42d Sts. in New York City. Among the incorporators are Austin Corbin, Benj. Norton, E. B. Hinsdale and others. The scheme includes the construction of a tunnel under the East River, and is probably intended to give the Long Island R. R. an entrance into New York City.

FOREST CENTRAL.—Chartered in Pennsylvania to build a railway from Tionesta to Kellettville, Pa. F. F. Whittekin, Tionesta, Pa., Pres.

EAGLES MERE.—Ground has been broken on this 6-mile railway from Sonestown to Eagles Mere, Pa. Pres., A. J. Maloney, Philadelphia.

MARYLAND & WASHINGTON.—A bill has been introduced into the Maryland Legislature chartering this company with power to build a railway from the outskirts of Washington, D. C., to Branchville, Md., and ultimately to Laurel, Md. It may be operated by steam, electricity, cable, horse or any other power. Among the incorporators are J. C. Blandon, E. H. Newman and Ellis Spear.

Southern.—Existing Roads.

LOUISVILLE & NASHVILLE.—This company has ordered Contrs., Munday, McTighe & Co. to begin work on the 7-mile gap of the Clarksville Mineral R. R. from Marion to near Van Leer, Tenn., and to complete the line as soon as possible. This company has, it is stated, submitted a proposition to the citizens of Cadiz, Ky., and vicinity to build a branch from Gracey, Ky., to that place.

ROANOKE, FINCASTLE & CLIFTON FORGE.—Work has been resumed on this road by a force of about 50 men, and it is expected to have the 12 miles between Fincastle and Cloverdale, Va., completed by July 1. Ch. Engr., J. K. Brown, Roanoke, Va.

CHESAPEAKE & OHIO.—The stockholders have authorized bonds to be issued to provide for constructing or acquiring branches and the general improvement of the road, including the making of it a double track system.

SAVANNAH, AMERICUS & MONTGOMERY.—According to the reports in local papers, arrangements have been made for beginning the construction of the proposed extension to Savannah, Ga.

SOUTH FLORIDA.—The branch from Pemberton Ferry to Inverness, Fla., 21 miles, has been completed. Three miles of the track were laid in 1891.

OHIO VALLEY.—Grading is nearly completed on the extension of the Huntington & Big Sandy R. R.

OXFORD & COAST LINE.—A contract has been closed with the Seaboard Air Line System by which this proposed line from Oxford, N. C., to Nashville or Rocky Mount, N. C., will be operated as a part of that system.

Projects and Surveys.

MOBILE, TUSCALOOSA & FLORENCE.—Ch. Engr. John A. Milner, 44 Hood Building, Birmingham, Ala., writes us that the surveys have been made for this proposed road, and that estimates of cost of construction are now being prepared. The proposed line runs from Mobile, Ala., via Mt. Vernon, St. Stephens, Linden, Gallion, Greensboro, Carthage, Tuscaloosa, Jasper, Double Springs, and Mt. Hope, to Florence, Ala., 351.4 miles. The maximum grade is 39.6 ft. per mile and the maximum curve is 6°.

ISBELL & IRON MT.—The contract to build this road, from Isbell, Ala., to ore mines on Iron Mt., has been let to T. A. Clark, of Isbell, Ala.

AMERICAN COAL CO.—This company proposes to build a branch from its coal property to the Georgia Pacific R. R., a distance of 3¼ miles.

HINTON & NEW RIVER.—A press dispatch states that T. C Hackett has been engaged to make the surveys for this proposed railway from Hamilton, W. Va., to the mouth of East River. Surveys will begin at once and the contracts let soon.

PETERSBURG & CHESTERFIELD.—It is stated that arrangemnts are being made to build this road. C. F. Z. Caracristi, Petersburg, Va., Gen. Man.; Francis R. Fava, Washington, D. C.; Cons. Engr.

CHARLESTON, CLENDENNON & SUTTON.—The contract for building the first 20 mile section of this road has been let to Worthington, Elliott & Debardleben, of Birmingham, Ala. The work is to be completed by Dec. 1, 1892.

VIRGINIA.—The following bills have been introduced into the Virginia Senate: Chartering the Norfolk & Lynnhaven R. R. & Terminal Co. to build a railway from Norfolk, Va., to Lynnhaven Bay; the Roanoke Valley R. R Co., the Fredericksburg & Norfolk R. R. Co., the Virginia Central R. R. & Navigation Co., and the Jonesville R. R. Co.

Northwest.—Existing Roads.

DULUTH, MESABI & NORTHERN.—The contractors, Grant & Foley, have sublet the contract for building the first 65 miles of this road from Duluth, Minn., to the Mesabi Mts.

IOWA CENTRAL.—There is a report in circulation that this company will build a line from Fremont to Ottumwa, Ia., about 10 miles.

FOREST CITY & SOUTHWESTERN.—It is stated that this company, which built a railway from Gettysburg to Forest City, S. Dak., 16 miles, in 1890, will soon begin work on an extension south if arrangements can be made.

NORTHERN PACIFIC.—The citizens of Walhalla, N. Dak., are making an effort to secure the construction of a branch to that place. It is stated that the company has assured the people that if the right of way is granted the branch will be built.

Projects and Surveys.

ROCKFORD TERMINAL.—Chartered in Illinois to build a railway from the city of Rockford, Ill., to a point on the Elgin, Joliet & Eastern Ry., at or near Aurora, Ill., with a belt line surrounding the city of Rockford. Among the incorporators are De Clarmont Dunlap, of Rockford, and Fremont Hill, of Chicago.

ILLINOIS & IOWA RY. & TERMINAL CO.—The officers of this company, whose incorporation was noted in our issue of Feb. 20, 1892, are: Pres., Morris Rosenfield, Moline, Ill.; V.-P., E. H. Thayer, Clinton, Ia.; Treas., M. L. Marks, Davenport, Ia., and Sec., E. H. Whitcomb, of Davenport, Ia. The company proposes to build a line from Clinton, Ia., to Davenport, Ia., and Moline, Ill., and a belt line connecting the three cities.

Southwest.—Existing Roads.

PAN AMERICAN.—A press dispatch says. C. L. Leslie, assistant to Gen. Supt. Geo. L. Sands, of the San Antonio & Aransas Pass, has returned from a short trip to Corpus Christi. He reports that the effects of the defunct Pan American road have been sold by the sheriff at auction to satisfy a $30,0 0 judgment. The property consisted chiefly of ties, telegraph poles, an engine and several flat and box cars. The new Pan American line now building from Victoria purchased the rolling stock of the defunct company. In regard to the new Pan American line, J. M. Brownson, a prominent banker of Victoria, is reported as saying: "Work on the line is progressing as well as might be expected. There are plenty of men and teams on the ground pushing the work of grading. The ties are ready for laying and a cargo of steel rails is now on the way. The stretch through the Guadalupe River bottom west will be put in condition for the passage of the construction train in a short time.

HOUSTON & TEXAS CENTRAL.—An extension from Ennis, via Milford and Hillsboro, to Whitney, Tex., is reported as determined upon.—Surveys were reported in progress for a line from Albany, Tex., via Chillicothe, to Altus, Tex.—The surveys have been completed for the proposed extension to Greenville.

SAN ANTONIO & ARANSAS PASS.—An amendment has been filed in Texas to the charter of this company for the construction of a branch line from the crossing of the road with the Guadalupe River, in Kendall Co., through Kendall, Gillespie, Llano and San Saba counties to a connection with the Gulf, Colorado & Santa Fe Ry., at Brownwood, in Brown Co., a distance of 150 miles.

MISSOURI PACIFIC.—It is stated that the report, noted in our issue of Feb. 20, that this company would build the Jefferson, Boonville & Lexington extension from Jefferson to Boonville, Mo., this season has been confirmed by an officer of the company. It is stated that work will begin as soon as the frost is out of the ground.

MISSOURI, KANSAS & TEXAS.—The officials of this company are looking over the ground with a view of extending its line from Colmesneil, Tex., east to the Louisiana lines.

Projects and Surveys.

BRECKENRIDGE RY. & NAVIGATION CO.—Chartered in Louisiana for the purpose of constructing and operating railways in the Parish of Livingston.

ARKANSAS CITY, OKLAHOMA & TEXAS.—At a recent meeting of the directors the following officers were elected: Pres., F. M. Strong; V. P., J. V. Achmire; Treas., C. R. Sives; Sec., T. W. Eckert, Arkansas City, Kan.

Rocky Mt. & Pacific—Existing Roads.

RIO GRANDE WESTERN.—Several short branches will be built this year to mines in the vicinity of Eureka, Utah.

COLORADO MIDLAND.—Surveys are in progress for a branch from near Florissant, Colo., to the Cripple Creek mines, about 13 miles. It is stated that construction will be commenced at an early date.

CARSON & COLORADO.—It is stated that this company has been completely reorganized with the following directors: D. O. Mills, Edgar Mills, F. G. Newlands, Geo. Whitten, Thos. Bell Randall, Horace Hill, H. M. Lexington and Wm. S. Wood. The object of the new organization is to build the long talked of extension from Keeler to Mojave, Cal., on the Southern Pacific R. R., 132 miles.

PORT TOWNSEND SOUTHERN.—A press dispatch from Port Townsend, Wash., says: Supt. S. F. Bush, of the Oregon Improvement Co., is in the city, and in an interview said he could give no definite information when work would be resumed on the company's lines in this state. Gen. Man. Smith is expected home from New York in two weeks, when the company's plans will be known. Bush thinks that the Port Townsend Southern Ry. will be completed to Olympia this year. Work will begin at both ends of the line, and 4,000 men will be put in the field.

NORTHERN PACIFIC.—A press dispatch says: "The Northern Pacific Railroad Co. is pushing the work on its new line from Chehalis, Wash., on the Pacific division, to South Bend and Willapa Harbor, which is about 100 miles north of the Columbia River. It is expected that the line will be completed by July 1. This will open up another deep harbor on the Pacific coast, and one of the best timber sections in the state of Washington. It is the intention of the Northern Pacific to run steamers around South Bend to Portland and San Francisco.

SOUTHERN PACIFIC.—The line from Santa Margarita to Ellwood, Cal., has been definitly located. It will be 130 miles long and follows closely the coast. This line is generally easier to build than the inland line first proposed, although there will be some very heavy work on portions of it. In the first 16 miles south from Santa Margarita there are seven tunnels, the longest of which is 3,600 ft. The contracts have not been let for building these tunnels, but bids are now being considered and a considerable preliminary work is being done.

GREAT NORTHERN.—The Montana Midland R. R Co. has been organized to build the railway over the surveys made by this company from Neihart to Castle Point, Mont., 45 miles. Work will begin at once and the line completed by Sept. 1, 1892.—The grading on the Pacific Extension between Sand Point, Idaho, and Bonner's Ferry is completed and the bridges are finished with the exception of the one across the Kootenai River at Crossport. Tracklaying will begin at once and be completed by the last of March.—The contract for the 13,000 ft. tunnel at Stevens Pass has not been let yet, it is stated, but will probably be secured by Shephard, Henry & Co., who will sublet the work to some firm making a specialty of such work.

Projects and Surveys.

PORTLAND, MT. TABOR & EASTERN.—This company will soon begin the construction of a 2-mile section of its proposed railway. Gen. Man., W. E. Daniel, 108 First St., Portland, Ore.

NAMPA RY. CONSTRUCTION CO.—Chartered in Idaho to build a line of narrow gage railway from Nampa, Idaho, to a point near Gold Hill, Boise Co., Idaho.

SANTA FE, PRESCOTT & PHŒNIX.—N. R. Gibson, Phœnix, Ariz., Ch. Engr., writes us that this line will be 200 miles long and will run from Ash Fork, on the Atlantic & Pacific R. R., via Prescott, Congress and Vulture, to Phœnix, Ariz. The preliminary surveys have been completed and 50 miles are located. B. Lantry & Sons, Strong City, Kan., have the contract for the first 50 miles from Ashfork south and Richmond Tooly has the contract for 20 miles from Phœnix north. It is intended to complete 50 miles this year and to have the entire line completed in about 18 months. The route is through a mountainous country for about 40 miles and the remainder is valley work. The maximum grade is 2% and the maximum curve is 10°. There will be five bridges, aggregating 1,050 ft. in length. D. B. Robinson, of New York City, is President.

ELECTRIC RAILWAYS.

BUFFALO, N. Y.—The Buffalo & Lancaster Electric Ry. Co. has been incorporated by Geo. M. Browne, Chas. Rossler and R. R. Ditzel, with a capital stock of $200,000. There will be about 20 miles of track.

GLOVERSVILLE, N. Y.—The Cayadutta Electric Ry. Co. has been incorporated by T. C. Trenyear, Buffalo, A. N. Broadhead, Johnstown, and C. M. Gibson, Schenectady, to build a line between Gloversville and Fonda. Capital stock, $120,000.

SOUTH BETHLEHEM, PA.—The South Bethlehem & Saucon Electric Street Ry. Co. has been incorporated with a capital stock of $100,000. Pres., Edwin Laufer.

READING, VA.—The Reading & Temple Electric Ry. Co. has been organized to build a road 5 miles long. Capital stock, $30,000. Pres., John A. Rigg.

SPOKANE, WASH.—The Short Electric Ry. Co., of Cleveland, O., has a contract for 3 miles of electric railway between Spokane and Montrose.

ELEVATED AND CABLE RAILWAYS.

CHICAGO, ILL.—The Northern & Western Ry. Co. has been incorporated by L. D. Condee, John A. Rose and O. S. Bass, with a capital stock of $10,000,000, to build an elevated railway from 39th and Halstead Sts. to Irving Boulevard and Milwaukee Ave.—The Chicago & South Side Rapid Transit Co. has given the contract for the extension of its structure from 39th St. to Jackson Park to the Keystone Bridge Co., of Pittsburg, Pa. This road was described in our issue of Jan. 16.

OAKLAND, CAL.—The directors of the Piedmont cable road have decided to commence at once the construction of the 14th St. cable branch to the 16th St. station, and do away with the horse cars. It is expected to have the road in operation by May.

HORSE RAILWAYS.

NEWARK, N. J.—The New Jersey Traction Co. has been organized to acquire the street railways of Essex, Hudson and Union counties. Among the incorporators are T. C. Barr and A. Q. Keasbey, of Newark. Capital stock, $500,000.

GRAND FORKS, N. DAK.—The Grand Forks Street Ry. Co. has been granted a franchise for a line which is to be built this year. C. Farrell and J. C. Stevens, of St. Paul, Minn., are at the head of the enterprise.

HIGHWAYS.

VIRGINIA.—The Board of Supervisors of Augusta County have recommended the passage of a bill authorizing the county to issue $150,000 in bonds for road improvement.

WASHINGTON.—A vote will be taken this week on the proposition to bond Whatcom County for $400,000 for 20 years for the purpose of constructing and improving highways. The roads shall be, where gravel is found, turnpiked and ditched on each side of the road, and where necessary they shall be constructed of split cedar and covered with gravel. Planking only to be used where absolutely necessary. The lines mapped out for improvement will cover about 200 miles, reaching all the principal points in the county.

BRIDGES, TUNNELS AND CANALS.

KENT CO., DEL.—The residents of Milford Neck are making endeavors to secure the construction of a bridge over the Murderkill River at Bower's Beach. The structure will cost about $7,000.

CLEVELAND, O.—Bids will be received for repairing the iron-work and masonry of the Main St. bridge.

EAGLE LAKE, TEX.—There is talk of building an iron bridge across the Colorado River near this place to cost about $25,000.

TACOMA.—The Washington Bridge Co. has been organized to build bridges and other structures.

WATER-WORKS.

New England.

LISBON FALLS, ME.—The construction of water-works and sewers will be considered at the town meeting, March 14.

BERLIN, N. H.—The Berlin Aqueduct Co. has voted to put in works to supply Berlin and Berlin Falls.

PETERBOROUGH, N. H.—The charter of the Peterborough W. Wks. Co., granted Feb. 18, 1891, has lapsed on account of the failure of the company to organize.

FALL RIVER, MASS.—Specifications for the new tank provide for a structure 65 by 56 ft., to be built of the best refined iron having a tensile strength of 55,000 to 60,000 lbs. The bottom of the tank will be ⅝ in. thick, and the sides will range from 11 16 ins. for the first 18 ft. to 5-16 ins. in thickness for the last 12 ft. A 12-and an 8-in. main will connect with the bottom of the tank. The foundation will be furnished by the city. The tank must be finished within four months from the date of the contract.

MARLBOROUGH, MASS.—M. M. Tidd, Boston, has been looking over proposed reservoir sites with Supt. Stacey. Surveys have not been made.

MILLBURY, MASS.—The Legislative Water Committee is considering a project for works here.

NORTH BROOKFIELD, MASS.—It is reported that the Water Commissioners think of securing a water supply from Doane's and Horse Ponds by raising dams some 6 ft. and flooding 160 acres.

ORANGE, MASS.—A bill has been reported by the Legislative Water Committee, which authorizes the town to take water from North Pond and to issue $125,000 of 4% 30-year bonds for works.

SPRINGIELD, MASS.—Engr. E. C. Davis, Northampton, has been engaged to make surveys for a new main from the Ludlow reservoir.

Middle.

AMSTERDAM, N. Y.—The Water Commissioners are considering the enlargement of the reservoir.

BUFFALO, ME.—It is reported that 8,000 bbls. of cement are to be bought for the new reservoir, Louis Knapp, Supt.

MECHANICVILLE, N. Y.—Gray & Temple, Lansingburg, have been awarded the contract for constructing the works at $37,200. R. D. Wood & Co. will supply pipe for $34,645.

SILVER CREEK, N. Y.—We are informed that Chas. C. Hopkins, of the Stanwix Engineering Co., Rome, has submitted plans and estimates for works.

SYRACUSE, N. Y.—The Water Board asks for proposals up to March 23 for building dam, bridge abutments, gatehouse and steel intake pipe in Skaneatles Lake.

OCEAN CITY, N. J.—A franchise has been granted to Ezra B. Lake and others. An attempt will be made to secure a supply from artesian wells, and if this is not successful it will be necessary to go to the mainland.

PERTH AMBOY, N. J.—The lowest bid for the new city works was by Mac Ritchie & Nicholl, Chicago, $160,500; the highest by John B. Foley, Philadelphia, $214,950. The contract will not be awarded for some days, owing to the fact that the Perth Amboy Water Co. is seeking to secure an injunction and prevent the city building works.

BRADFORD, PA.—The Blaisdell Water Co. has been incorporated to supply water to the Bradford Township, outside Bradford City; Treas., John W. Blaisdell; capital stock, $5,000, of which $1,000 is paid in.

CANONSBURG, PA.—At a recent citizens' meeting the majority favored borough ownership. Address Wilson Crane.

CHARTIERS, PA.—The Monongahela Water Co., which supplies the "South Side" of Pittsburg, has begun to lay pipe here. It is said that a section of the township of Stowe will be incorporated as McKees Rocks borough.

DAUPHIN, PA.—The Dauphin Water Co. has been incorporated; Treas., Henry Belin, Jr., Scranton; capital stock, $7,500, of which about $1,000 has been paid in.

HANOVER, PA.—The Council has called an election for April 19 to vote on the issuance of $75,000 of bonds, $50,000 for increasing the water supply by purchase, improvement or the establishment of a new plant, and $25,000 for an electric lighting plant.

HARRISBURG, PA.—The Keystone Water Co. has been incorporated; Treas., Henry Belin, Jr. Scranton, capital stock, $37,500, of which $3,750 has been paid in.

HARRISBURG, PA.—The commissioners have recommended the purchase of a 10,000,000-gallon high duty pumping engine.

McKEESPORT, PA.—The Water Commissioners have recommended meters for all except domestic service.

NEW MILFORD, PA.—Preliminary steps for the organization of a water company were taken at a recent citizen's meeting. Address F. G. Inderlied or E. S. Garratt.

PHILADELPHIA, PA.—An ordinance has been passed providing for a 10,000,000-gallon filtering plant at the Lardner Point pumping station on the Delaware River. The plant, it appears, will be put in by the Pennsylvania Filtration Co. at a cost of not over $150,000.

RIDLEY PARK, PA.—It is reported that the American Pipe Manufacturing Co., Philadelphia, has secured the contract of the Ridley Park Cold Spring Water Co. The former company, it is said, is connected with a project for consolidating several plants in the eastern and southern sections of Delaware County. When the scheme is carried out one pumping station will lift water to a reservoir from which the several towns will be supplied by gravity.

SCRANTON, PA.—A new dam and reservoir will be built on Stafford Meadow Brook, about two and a half miles from the city, by the Scranton Gas & Water Co.; capacity, 216,000,000 gallons; Engr., W. M. Marple; Contrs., Burke Bros., Scranton.

RUTLEDGE, PA.—The borough council has called an election for March 15, to vote on accepting the proposition of the Springfield Water Co., to lay a 6-in. main on Morton Ave. and 4-in. mains on intersecting streets; also to furnish 16 hydrants at a yearly rental of $400.

STEELTON PA.—The Steelton Water Co. has been incorporated; Treas., Henry Belin, Jr., Scranton; capital stock, $15,000, of which $1,500 has been paid in. A charter granted to a company some time since is now about run out, on account of failing to build works.

TROY, PA.—The town has voted against issuing $25,000 bonds for works.

LONACONING, MD.—It is stated that a company has procured land for a reservoir site, but has not yet secured a franchise.

Southern.

BERRYVILLE, VA.—It is reported that the town will borrow $15,000 for works. A company built works in 1891.

HUNTERSVILLE, VA.—A citizen's meeting has been held to discuss works. Address D. M. Harding, or J. A. Lesner. An investigating committee was appointed.

GREENSBORO, N. C.—It is reported that the Greensboro Water Co. proposes to add pumping machinery.

ROCK HILL, S. C.—Wm. F. Neff, Chattanooga, Tenn., representing Ferris & Richards, New York City, has visited this place and will probably make a proposition for a franchise.

SUMTER, S. C.—Works are still being discussed.

HOOKER, GA.—The Tenooga Co. proposes to put in works.

ALABAMA.—A franchise for building works in a town of about 7,000 inhabitants near Birmingham is advertised in our proposal columns by Vedeler & Kasbaum, Engrs.

HATTIESBURG, MISS.—Address the Mayor regarding proposed works.

CHATTANOOGA, TENN.—The City Water Co. has increased, or is about to increase, its bonded indebtedness from $1,000,000 to $1,500,000. It is said that improvements looking to a better supply are proposed.

North Central.

CINCINNATI, O.—The lower branch of the legislature has passed the bill authorizing new works at a cost of $6,000,000, the works to be built by a commission to be appointed by the Mayor.

DAYTON, O.—New hydrants and valves will be set and new mains laid.

GALLIPOLIS, O.—It is reported that the construction of works will be started about March 15.

HAMILTON, O.—Meters for all large consumers were ordered last fall and notices are to be sent out that all such consumers must have meters set by April 1.

NELSONVILLE, O.—It is reported that the town has decided to establish works.

OTTAWA, O.—It is reported that the water-works project lacked one vote in the City Council.

WILLOUGHBY, O.—The people having voted for municipal works the Council is now taking steps to secure authority to issue $30,000 of bonds for the plant.

WYOMING, O.—An election will be held April 4 to vote on the issuance of $35,000 for works.

BRIGHTWOOD, IND.—The Town Council has received proposals for sinking a shallow 8-in. well for $8.50 per ft. Water-works are proposed. Com. on W.-Wks., J. B. Caskey, J. B. Mansfield and G. F. Candell.

MARTINSVILLE, IND.—The Mayor has appointed a water-works investigating committee of five.

BAY CITY, MICH.—Negotiations for constructing a joint intake have been broken off.

FLINT, MICH.—The company has offered to sell its works to the city at a price to be determined by arbitration.

GRAND RAPIDS, MICH.—Cy. Engr. Collar has submitted an estimate of the cost of constructing an open filter gallery 11,000 ft. long, excavated to an average depth of 19 ft., 10 to 12 ft. of which would be in gravel. An arched brick conduit at least 62 ins. in diameter would extend 400 ft. to the river for use in case of emergency. The total cost of the gallery and connections is estimated at $81,000; the cost of the gallery being placed at $5 per lin. ft. The gallery is designed to yield 20,000,000 gallons daily. It is reported that the Water Commissioners do not favor the gallery. In addition to the above improvements the expenditure of $143,000 for the high and $14,000 for the low service system is under consideration.

ISHPEMING, MICH.—The pumping station was burned Feb. 26.

AVON, ILL.—It is reported that water and electric lighting plants will be put in.

CHESTER, ILL.—Surveys for water and lighting plants are to be made. Address Wm. Garland.

CHICAGO, ILL.—Proposed tunnel extensions beyond the plans now being carried out seem likely to be impossible, owing to lack of available funds.

ELGIN, ILL.—New mains will be laid.

JACKSONVILLE, ILL.—A survey for a new reservoir is to be made.

PANA, ILL.—Surveys for a reservoir, with a capacity of some 10,000,000 or 12,000,000 gallons, have been made for the Cleveland, Cincinnati, Chicago & St. Louis and Ohio & Mississippi Ry. Co.

WHITE FISH BAY, WIS.—The White Fish Bay Water, Light & Power Co. has been incorporated by C. R. Gether, David Harlowe and H. M. Gilbert; capital stock, $50,000.

Northwestern.

EAGLE GROVE, IA.—The people have voted in favor of water and electric lighting plants.

PRESTON, IA.—Works are projected.

HORTON, KAN.—Works are again being talked of.

PARSONS, KAN.—It is stated that the new pumping station will be at some distance from the city, and that the surveys are to be made by D. W. C. Perry.

REDWOOD FALLS, MINN.—Bonds for works have been sold at a premium and construction will be started as soon as the weather is suitable.

VALLEY CITY, N. DAK.—Water and electric lighting plants are projected, Alderman J. J. Barclay, Secy. Board of Trade.

PHILLIPSBURG, MONT.—The city has granted a franchise to Angus A. MacDonald, work to be started within 90 days from the acceptance of the franchise.

Southwestern.

INDEPENDENCE, MO.—The works will be sold under deed of trust on March 12. R. D. Wirt is now Receiver.

ST. LOUIS, MO.—Bids will be received by the Board of Public Improvements until March 15 for laying 11,000 ft. 20-in., 1,300 ft. 30-in., 200 ft. 6-in. and taking up 3,000 ft. of 6-in. pipe; also for setting 10 hydrants and furnishing 1,000 lbs. of wrought iron straps and bands. E. S. Foster, Secy.

LITTLE ROCK, ARK.—An ordinance has been introduced in the City Council providing for the laying by the Home Water Co. of 200 ft. of 14-in., 1,200 ft. of 12-in., 5,280 ft. of 10-in. and 19,720 ft. of 6-in. mains and the setting of 50 hydrants.

VAN BUREN, ARK.—The Council has accepted the proposition of the Southern Improvement Co., Dallas, to put in works, under a 25-years franchise. A survey has been made for a supply from Lee's Creek. The works are to be completed by Dec. 1, 1892.

AMARILLO, TEX.—The people have voted to incorporate as a town, and it is expected that more extensive works will be built.

AUSTIN, TEX.—Bids will be received by the Board of Public Works until April 18, for furnishing about 40 miles of 30 to 6-in. mains, 100 tons specials, 230 hydrants and connections, 10 air cocks, about 220 30 to 6-in. valves, and for laying pipe and setting valves and hydrants Mayor, John McDonald. Emile C. Geyelin, Philadelphia, has reported on the water-power plant for the new works and will prepare plans for a power house and two 3,000,000-gallons water-power pumps.

HILLSBORO, TEX.—The council proposes to contract for artesian wells and water-works.

HUBBARD CITY, TEX.—Address W. A. Collier regarding proposed works.

KOSSE, TEX.—Works are projected by the business men.

PALESTINE, TEX.—It is reported that several miles of new mains are proposed. Mgr., J. W. Oament.

Pacific.

GARFIELD, WASH.—A mass meeting to discuss works has been held and a committee appointed to investigate. Artesian wells are under consideration.

DALLAS, ORE.—An ordinance has passed the council which repeals the franchise granted to San Francisco parties represented by Chas. P. Thore. The city seems willing to grant a modified franchise to the same effect.

LONDO, IDA.—The Londo Water Co. has been incorporated; capital stock, $30,000.

Canada.

PORT ELGIN, ONT.—The council wishes estimates on works. Chn. Com. on Fire and Water, R. S. Muir.

ARTESIAN WELLS.

NEW ORLEANS, LA.—A city well in McCarthy Square is proposed.

YANKTON, S. DAK.—Cy. Engr. Palmer has located a site for a well for the north side works.

MOBERLY, MO.—Artesian wells are proposed for the water works.

LAS ANIMAS, COLO.—Wells are talked of.

COLFAX, WASH.—Dr. B. F. Hervey is said to be at the head of a movement to sink a well 2,000 ft.

SOUTH RIVERSIDE, CAL.—Two wells are to be sunk near the storage reservoir.

IRRIGATION.

FRESNO, CAL.—The Fresno Canal & Irrigation Co., formerly the Pine Ridge flume, has filed a declaration of intention to bond the flume for $300,000, to raise money for the construction of a flume from Fresno 57 miles to the timber belt of the Sierras. The purpose is to bring lumber down, also to carry water for irrigation purposes. By it 80,000 acres of raisin land can be watered. A billion feet of lumber is said to be tributary to the flume.

TRACEY, CAL.—Steps are being taken to organize an irrigation district.

POCATELLO, IDA.—The Idaho Canal Co. has offered and proposes to extend its canal to Pocatello, and has offered to supply the town 1,000 ins. of water during the irrigating season for $5,000 per year.

NEW COMPANIES.—Harriman Ditch Co., Jefferson Co., Colo; J. W. Bowles, H. W. Lake, W. C. Henry; $40,000; to take water from Bear and Turkey Creeks. Powers & Kiowa Ditch Co., Kiowa Co., Colo.; W. P. James, J. A. Williams; $15,000; ditch from Big Sandy Creek. East Side Canal Co. of Kern Co., Bakersfield, Cal.; directors, J. J. Mask, J. E. Smith; $500,000. Kern River Canal & Irrigation Co., Bakersfield, Cal.; directors, Walter James, C. Brower; $250,000. Lienberger Ditch Co., Grangeville, Cal.; Henry Dawson, W. A. Long; $19,000. Beckwith Canal & Lumber Co., San Francisco, Cal.; $3,500,000, dealing in water and water rights, operating flumes, etc. Lava Side Ditch Co., Bingham Co., Ida.; L. J. Porter, J. C. Fisher; take water from Snake River.

SEWERS.

BOSTON, MASS.—The lowest bids for building sections 13 and 14, Chelsea, of the Metropolitan sewerage system, were those of the Metropolitan Construction Co., $173,754 and $148,857 respectively. The lengths are 3,810 and 3,440 ft. Bids are asked until March 8 for building a section of the outfall sewer on the embankment between Squantum and Moo Island. Approximate quantities: excavation and refilling, 1,865 lin. ft.; brick masonry, American cement mortar, 1,311 cu. yds.; same, Portland cement mortar, 482 cu. yds.; concrete masonry, 7,500 cu. yds. Address Wm. Jackson, Cy. Engr., City Hall.

WORCESTER, MASS.—The city has appropriated $88,000 for sewers and $25,000 for street construction during the ensuing year.

BUFFALO, N. Y.—The council has directed that specifications be prepared for sewers in three streets; also that a 12 to 54-in. tile and brick sewer be constructed in Ontario St., and that bids be asked for its construction.

NORWICH, N. Y.—Mr. Walter F. Randall, of Syracuse, is preparing plans and specifications for a system of sewers. It is thought that about 18 miles of pipe will be required, and the total cost be less than $100,000.

SUSPENSION BRIDGE, N. Y.—Bids will soon be asked for the completion of the sewerage system.

NEWARK, N. J.—Ordinances have been passed for pipe sewers in six streets.

BIRMINGHAM, ALA.—The Council has voted in favor of a joint sewerage system between the city and the town of Highlands. The estimated cost is $20,000.

MEMPHIS, TENN.—Mr. Jas. H. Elliott, Asst. Engr. in charge of the sewers, recommends that surveys be ordered at once for the construction of four sewers, to cost about $72,000.

NASHVILLE, TENN.—The council has appropriated $45,000 for a brick sewer.

COLUMBUS, O.—The Board of Public Works has declared it necessary to construct a main trunk sewer in two streets, to cost $30,059.

MANSFIELD, O.—Mr. George E. Waring, Jr., has completed plans for the proposed system. The total length is about 27 miles, and the estimated cost $100,000.

CEDAR RAPIDS, IA.—Bids have been opened for about 4¼ miles of 8 to 24-in. pipe sewer. The lowest was that of A. H. Connor, $17,995, and the highest, $47,878.

CRESTON, IA.—A complete system of sewerage is reported as to be built the coming season.

KANSAS CITY, MO.—Bids are asked until March 10 for sewer construction in two districts. E. Butts, Cy. Engr.

ST. LOUIS, MO.—Plans are being prepared for a sewer under Grundy or Filmore St. in Carondelet, to cost $30,000. The Sanitary Department is much interested in sewering the district bounded by the city limits, River des Peres, Pine St. and Page Ave. It is estimated that to properly drain this will cost $350,000.

BEAUMONT, TEX.—Plans are being prepared for a complete system. Address the Mayor.

SANTA ANA, CAL.—The City Engineer finds that a complete system with 18-in. clay pipe mains, and discharging into tidewater at the head of Newport Bay, will cost $70,600; or terminating on a sewage farm will cost, including farm, $38,700; and a 16-in. pipe system, $50,000 terminating in tidewater, or $29,200 on the farm.

WINNIPEG, MAN.—Bids are asked until March 17 for the construction of sewers on certain streets. J. W. Cockburn, Chairman Committee on Works.

STREETS.

SOMERVILLE, MASS.—The total estimate for paving Somerville and Webster Aves. with granite blocks is $96,780. The city desires authority to issue bonds for $100,000 for this work.

SOUTH HADLEY, MASS.—The Street Committee estimates that it will cost $17,974 to concrete all the walks in the village.

BROOKLYN, N. Y.—Bids were opened March 1 for improving two streets. The lowest for paving Seventh St. with granite blocks was that of Thomas Monahan, $8.90 per lin. ft., and for paving Thirty-second St. with cobble stone, Hickey Bros., $3.97 per lin. ft.

FLATBUSH, N. Y.—The contract for improving Nostrand Ave. with broken stone has been awarded to Frederick Lick, at $2.98 per lin. ft. Mr. Lick has also the contract for grading, paving and curbing Flatbush Ave.

HACKENSACK, N. J.—The town has voted to issue $30,000 of bonds to finish macadamizing the streets.

BRADDOCK, PA.—The council is preparing plans for the paving of several new streets.

WILMINGTON, DEL.—The Legislature in 1891 authorized the City Council to borrow $500,000 for street paving, and the Street and Sewer Department has prepared estimates for the proposed work. The total area is about 250,000 sq. yds., to cost $490,699, including granite blocks, $224,991; fire brick, $173,336; macadamizing, $47,807. Work will begin this spring, and it will take three years to complete it.

BALTIMORE, MD.—The Mayor has signed ordinances for paving two streets with asphalt blocks, estimated cost $160,000, and two with Belgian blocks, $213,000.

ATLANTA, GA.—The Council has ordered Belgian blocks laid on four streets, at a cost of about $45 000.

CHATTANOOGA, TENN.—Bids for paving have been opened, amounting to about $105,000, and contracts awarded to J. A. Gillespie, granite on concrete; Southern Construction Co., brick; Warren-Scarff Asphalt Co., asphalt; Howard Neely, telford macadam.

NASHVILLE, TENN.—The council has appropriated $6,068 for brick paving and $10,000 for laying a trial specimen of Kentucky rock asphalt.

AVONDALE, O.—Bids are asked until March 26 for grading, curbing and paving one street with telford macadam and wearing surface of crushed granite, or with asphalt on concrete foundation. W. E. Wynne, Clerk.

INDIANAPOLIS, Ind.—The City Engineer has prepared estimates for 15 paving contracts, and the Board of Public Works will soon ask for bids.

GRAND RAPIDS, MICH.—The committee is considering the apportionment of the $200,000 street paving fund. The estimates for one street are $47,708 for cedar blocks on concrete base, $35,381 for same on gravel and $34,658 for macadam.

APPLETON, WIS.—The council has ordered the paving of the three principal streets.

MOLINE, ILL.—Estimates have been prepared for paving to cost $27,193.

CRESTON, IA.—About two miles of paving will be done this year.

KEOKUK, IA.—The clerk of the City Council will receive bids until April 4 for paving Main St. with brick. The approximate quantities are 17,554 sq. yds. of paving; grading, 14,000 cu. yds.; curbing, 4,000 lin. ft. W. H. Jones is City Engineer.

WINONA, MINN.—As soon as the weather will permit considerable cedar block paving will be done.

MONTREAL, QUE.—The Road Department is preparing plans for the Berri St. subway, to cost $110,000 if 60 ft. wide and $72,000 if 50 ft. wide, also estimates for widening Common St. from 35 to 100 ft.

ELECTRICAL.

READING, PA.—The contract for city lighting has been awarded to the Reading Electric Light Co. at $100.50 per light for 250 to 350 lamps of 2,000 c. p. each, the lights to burn all and every night, and $20.40 per light for 500 to 700 incandescent lights.

CINCINNATI, O.—No bids were received by the Committee on Light, but each local company sent in a communication claiming that the specifications were such as to preclude the offering of a bid.

INDIANAPOLIS, IND.—The city has contracted with the Brush Co. for 750 arc lights of 2,000 c. p. for 10 yrs. at $85 each per year on the moonlight, or $90 on all night, schedule. The lamps are to be suspended on mast arms, and the city can order additional lights on 30 days' notice.

EAGLE GROVE, IA.—The City Council has voted in favor of electric lights, and a plant to cost about $20,000 will be put in by eastern capitalists.

NEW COMPANIES.—Little Falls Electric Light & Power Co., Little Falls, N. Y.; $30,000; J. H. Ives, W. F. Lansing and G. O. Oppel. Buffalo & Niagara Falls Electric Light & Power Co., Buffalo, N. Y.; $100,000; Geo. Urban, Jr., of Cheektowaga; Jas. Roberts, of Buffalo; Daniel O. Day, of New York City. Roseburg Electric Light & Power Co., Roseburg, Ore.; $20,000; J. E. Hurd, Otey Boon and L. L. Hurd. Menominee Electric Light Co., Menominee, Wis.; $30,000; Edbert Marks, A. H. Johnson and Albert Quilling. American Elevator Co., Milwaukee, Wis.; $500,000; E. H. Smith, S. R. Miller and W. J. Kayser.

CONTRACT PRICES.

PAVING.—Memphis, Tenn.—Six bids have been opened for paving Second St., ranging as follows: For new stone curbing, furnished and set, 62 to 80 cts. per lin. ft., and $5.50 to $6.50 per corner; granite crosswalks, 65 to 90 cts. per lin. ft.; cast iron drains, 1 8 to 2 cts. per lb.; removing old pavement, furnishing sand and pitch and laying brick pavement, $1.19 to $1.58 per sq. yd.; resetting old curb, 3 to 10 cts. per lin. ft.

BRICK.—Franklin, Pa.—The contract for about 500,000 brick has been awarded to the Franklin Paving Brick Co., at $10 per M. delivered.

MISCELLANEOUS.

IRON PLATES AND ROOFING COPPER.—Washington, D. C.—Bids are asked until March 14 for tinned sheet copper and galvanized sheet iron ribs for roofs and portico flashings of the Congressional Library; also until March 19, for cast iron trench and floor plates, etc., for the same building. Bernard R. Green, Supt. and Engr.

BUILDING.—Helena, Mont.—Bids will be received until April 29 for the construction of the Montana State building at the World's Fair. Jas. G. Ramsay, Secy. World's Fair Managers.

JAIL.—Corsicana, Tex.—Bids are asked until March 14 for the erection of the Navarro County jail, separate bids being required for the steel and iron work; also for hot water, steam or hot air heating. The County Clerk.

ELEVATORS.—Cincinnati, O.—The City Hall Trustees have opened the following bids for three passenger elevators: H. J. Reedy & Co., two hydraulic, $6,400; one electric, $2,900; Central Thomson-Houston Co., electric, $3,500 each; Sprague Electric Co., electric, $5,350 each; Hale Electric Co., all three, $12,527.

DREDGING.—Milwaukee, Wis.—Bids are asked until March 30 for dredging about 8,000 cu. yds. at Green Bay Harbor, Wis. Maj. James F. Gregory, U. S. Engineer Office.

PIER.—Ottawa, Ont.—Bids are asked until March 31 for the construction of a new pier to support the lighthouse at Pointe aux Anglais light station. Wm. Smith, Deputy Minister of Marine.

DRAINAGE.—Tacoma, Wash.—Estimates are being prepared for the draining of the entire system of "muck" swamps lying south of the city, comprising about 15,000 acres of good farm land.

PAVING AND SEWER SUPPLIES.—Memphis, Tenn. The Board of Fire and Police Commissioners will receive bids until March 10, for supplies for 1892, including sewer and drain pipe; fire clay paving brick; brick for sewers, culverts, bridge work and side walks; cementing gravel for foundations and paving roadways.

GAS.—Jersey City, N. J.—The Consolidated Gas Improvement Co. has been incorporated by J. E. Leadley, of Nyack, N. Y.; J. S. Elkins, of New York City, and R. Boekler and others, of Brooklyn; capital, $500,000.

Memphis, Tenn.—The Equitable Gas Co. offers to furnish 500 or more lights at $1 each per month, and less than 500 at $1.50 each. The expired contract fixed the price at $1.10 per light, and during the interim the company receives $1.50 each.

MANUFACTURING AND TECHNICAL.

LOCOMOTIVES.—The Baldwin Locomotive Works, Philadelphia, Pa., have delivered some freight engines to the Rio Grande Western and West Virginia Central. The New York Locomotive Works, Rome, N. Y., are building passenger engines for the Rio Grande Western. The Pennsylvania will build this year 250 engines for lines east of Pittsburg, and 150 for lines west of Pittsburg. They will all be heavy engines, the freight engines being designed to haul trains of 40 loaded cars over steep grades.

CARS.—The Terre Haute Car Co., Terre Haute, Ind., has an order for 600 Hicks stock cars for the Cleveland, Cincinnati, Chicago & St. Louis. The Pullman Palace Car Co., Chicago, Ill., is building 85 passenger cars for the Philadelphia & Reading. The Laclede Car Co., St. Louis, Mo., is building 200 closed and 175 open cars for the cable line of the Third Ave. Ry., New York. The Lewis & Fowler Mfg. Co., Brooklyn, N. Y., and J. G. Brill Co., Philadelphia, Pa., are building eight-wheel open cars for the Brooklyn City Ry.

CAR SPRINGS.—Robert B. Johnston & Co., New York, manufacturers of concave elliptic car springs, have an order from the Pennsylvania for 100 springs, to be put under 25 drawing room cars being built at Altoona.

MINERAL WOOL.—The Western Mineral Wool Co., Cleveland, O., has orders for about 700 tons for Chicago buildings.

THE NYE STEAM VACUUM PUMP CO., Chicago, Ill., is building a gravel pump with a capacity of 1 cu. yd. per minute for A. Jewett, Rogers Park, Ill.

THE LAIDLAW & DUNN CO., Cincinnati, O., has opened a branch house at 199 South Canal St., Chicago, and will carry a stock of pumps, railways supplies, etc.

THE BERLIN IRON BRIDGE CO., East Berlin, Conn., reports its works running full time and crowded with orders. The company is building railway bridges for the New York, New Haven & Hartford, and a number of highway bridges. Besides iron buildings recently noted it has on hand contracts for a boiler shop 115 × 370 ft., for the Wm. Cramp & Sons Ship & Engine Building Co., Philadelphia, Pa.; beams, girders, roof, etc., for a building for the National Fire Insurance Co., Hartford, Conn.; an iron boiler house for the Montgomery Furnace, Pt. Kennedy, Pa., and a casting shop 60 × 167 ft., for the American Tube Works, Somerville, Mass.

NEW COMPANIES.—Bogler Automatic Safety Car Coupler Co., Chicago, Ill.; $5,000,000; Philip Bogler, O. Knederling and C. Dietz. Safety Brake Shoe Construction Co., Portland, Me.; $500,000; S. Burger and D. N. Cook, Salem, Mass., and John S. Baker, Beverly, Mass. O'Neil Crossing Alarm Co., Chicago, Ill.; $500,000; W. D. Drake, J. G. O'Neil and W. P. Johnson. American Street Railway Track Co., New Jersey; $300,000; Edward Dudley, Camden, N. J.; Edward Greeley, New York; C. E. Heller, S. D. Nye and R. T. White, of Boston, Mass. Hall Engineering Co., East St. Louis, Ill.; $30,000; Thomas V. Hall, J. H. Henry and F. H. Hoose. Pittsburg Car Wheel Co., Pittsburg, Pa.; R. J. Mercur, J. D. Callery, P. H. Griffin. American Hydraulic Dredging Co., Chicago, Ill.; $250,000; Charles L. Plumb, R. L. Latham and C. R. Webster. Economic Power Co., Chicago, Ill.; $1,500,000; Judson Lattin, T. Burkhard and R. C. Young.

CURRENT PRICE LIST.

RAILS.—New York: $30 at eastern mills; old rails, $20 to $20.50 for iron and $14 to $15 for steel; girder rails, $40. Pittsburg: $30; old rails, $22 to $22.50 for iron and $16.75 to $17.25 for steel. Chicago: $31.50 to $32; old rails, $20.75 to $21 for iron and $14 for steel.

TRACK MATERIALS.—New York: steel angle bars 1.65 to 1.7 cts.; spikes, 1.95 to 2.05 cts.; track bolts, 2.6 to 2.75 cts., with square and hexagonal nuts. Pittsburg: splice bars, 1.7 to 1.8 cts. for iron or steel; iron or steel spikes, 2.15 cts.; iron track bolts, 2.65 cts. with square and 2.75 cts. with hexagon nuts. Chicago: splice bars, 1.8 cts. for iron and steel; spikes, 2.15 to 2.2 cts.; track bolts, 2.65 to 2.8 cts. with hexagon nuts.

PIPE.—Cast iron, $20 to $30 per ton. Wrought iron, discounts as follows, at Pittsburg: 57½ and 47½% on black and galvanized butt-welded; 67½ and 55% on black and galvanized lap-welded. Casing, 55%.

FOUNDRY PIG IRON.—New York: $14 to $17.50. Pittsburg: $14 to $15.75. Chicago; $14 to $16.

LEAD.—New York: 4.15 to 4.2 cts. Chicago: 4 cts. St. Louis: 3.9 to 3.95 cts.

STRUCTURAL MATERIAL.—New York: beams, 2.3 to 2.8 cts.; channels, 2.3 to 2.5 cts.; angles, 1.9 to 2.1 cts.; tees, 2.4 to 2.75 cts.; sheared iron plates, 1.85 to 2.25 cts.; steel plates, 1.85 to 2.1 cts. for tank, 2.15 to 2.3 cts. for shell, 2.4 to 2.65 cts. for flange, 3 to 3.25 cts. for firebox. Pittsburg: beams, 2.35 to 2.45 cts.; channels, 2.35 to 2.45 cts.; angles, 1.9 to 1.95 cts.; tees, 2.5 cts.; universal iron mill plates, 1.95 to 2 cts.; sheared steel bridge plates, 1.9 to 2 cts.; refined bars, 1.75 cts.; steel plates, 1.9 to 2 cts. for tank, 2.15 to 2.2 cts. for shell, 2.3 to 2.35 cts. for flange, 3.75 to 4.15 cts. for firebox. Chicago: beams, 2.25 to 2.4 cts. for standard, 2.57 cts. for small, and 2.6 to 2.75 cts. for 20-in.; channels, 2.67 to 2.75 cts.; angles, 1.95 to 2.1 cts.; tees, 2.25 to 2.5 cts.; universal plates, 2.12½ cts.; sheared steel plates, 2.2 to 2.25 cts.; steel plates, 2.3 to 2.4 cts. for tank, 2.6 to 2.75 cts. for shell, 2.9 to 3 cts. for flange.

Northville, Mich., Water Works.

NOTICE.

Sealed proposals for cast iron water-pipe, and specials, vitrified pipe, building reservoir, pipe laying, valves and hydrants will be received at the office of the Board of Water Commissioners, Northville, Michigan, until 7:30 p. m. Friday, March 11, 1892.

There will be required about

6,150 feet of 10 inch pipe.
3,000 " " 8 " "
13,400 " " 6 " "
6,200 " " 4 " "
Also about 10,000 " " 10 " " vitrified

double strength water pipe, 15,000 pounds special castings, 34 valves 4 to 10 inches, 34 valve boxes, and 50 double nozzle hydrants.

Building Reservoir and laying the above pipe.

Specifications, proposals and form of contract can be had at the office of the Water Commissioners.

Each bid must be accompanied with a certified check for $500.00. The Water Commissioners expressly reserve the right to reject any and all bids should they deem it for the interest of the village, also reserve the right to increase or diminish the above quantities as may be necessary to complete the works.

WM. AMBLER,
FRANK CLARK,
J. A. DEBAR,
W. S. PARKER,
} Board of Commissioners.

Consulting Engineer

10-1t Pontiac, Mich.

Notice to Contractors.

Bids wanted for the construction and completion of the Montana state building at the World's Columbian Exposition, Chicago, Ill.

Plans, specifications and details can be seen at the following places:

Office of secretary, Helena, Mont.
Galbraith & Fuller, Missoula, Mont.
Galbraith & Fuller, Livingston, Mont.
Builders' Exchange, Chicago, Ill.

All bids must be accompanied by a certified check for $2,000.

The Board of World's Fair Managers reserve the right to reject any and all bids.

All bids must be filed in the office of the secretary on or before 12 o'clock noon of Friday, April 29, 1892.

JAS. G. RAMSAY, Secretary.

Rooms 34 and 35 Montana National Bank Building, Helena, Mont.

GALBRAITH & FULLER,
Superintendent Architects.

Notice to Jail Builders.

Sealed proposals are invited and will be received on the whole, or parts of the works, for the building of the Navarro county jail at Corsicana, Tex., until noon Monday, March 14, 1892.

The plans and specifications can be seen at the office of the county clerk at Corsicana, or at the office of J. R. Minor, architect, Corsicana, Tex., on and after the 22d day of February to March 14, 1892, inclusive.

Bids are required on the steel and iron work separate from the other work.

Bids (with specifications) also solicited for hot water or steam heating, or hot air heating, separate from the other work.

A certified check, payable to the order of the county judge of Navarro county, in the sum of one thousand ($1,000) dollars, must accompany each proposal filed as a guarantee of good faith that the bidder will enter into a contract and furnish a satisfactory bond to the amount of one-half of the contract sum.

All proposals must be filed with the county clerk before the time above mentioned.

The right is reserved to reject any and all proposals received.

By order of the commissioners court.

JOHN H. RICE,
County Judge Navarro County, Tex.

50 Cts. **WANTS.** 50 Cts

WANTED—All consulting engineers, corporations, contractors, etc., to read Paret's advertisement about surveys. See page III.

WANTED—Continuous girders to calculate —either constant or variable Moment of Inertia.—New Graphical method—My own invention. Address C. H. LINDENBERGER, Wayne Hotel, Detroit, Mich. 35-52t

WANTED—Position as manager of water works, thoroughly competent to take full charge, understanding excavating and laying of pipes thoroughly. Can furnish best of references. Address A. L., care Engineering News. 1-1t

WANTED—Civil engineer to suggest and be employed to survey new railway line wanted in his locality. Send particulars as to self and route to "CAPITALIST," care Engineering News. 7-3t

WANTED.—Ex-chief engineer, Yale graduate, who understands Spanish, and has had 18 years' experience in United States, state, municipal and railway engineering work, and with credentials of the highest character, solicits correspondence with a view to an engagement. Address "X.," Engineering News. 4-15t

WANTED—A position on location or construction by experienced engineer, now engaged on construction on trunk line where work will finish in few days; has transit, level, and office instruments. Address R., care Engineering News. 8-3t

WANTED—A civil engineer, aged 34, desires employment. Experience in railway reconnoissance, location and construction, and in municipal engineering. Have just completed 13 sections and terminals at Roanoke, Va., for the Roanoke & Southern Ry. Refer to Andrew Onderdonk, Chief Engineer, R. & S. Ry., Winston, N. C. H. W. NEWBY, Alexandria, Va. 7-4t

WANTED—A position as office man in engineer's office; capable clerk and accountant, neat draftsman, etc. Nine years experience; disengaged in March. Address M. C., care Engineering News. 7-6t

WANTED.—A civil engineer, graduate, with experience on sewer work and general municipal engineering is open to engagement. Address B. A., care Engineering News. 8-3t

WANTED—By young engineer a position as instrument man, rodman or chainman on railway or city survey. Address ALONZO REED, Boyd, O. 8-3t

WANTED—Position in field or office by young college graduate of three months' office experience. Address, P. O. BOX 77, Moriches, Suffolk Co., N. Y. 8-3t

WANTED

A practical clay worker, with some capital, to take an interest in and superintend a plant for the manufacture of sewer pipe and other clay products, in a large Southern city, with railroad and water transportation in all directions, and where it will command the increasing demand for such products in the South. The best of clay exists in great variety and abundance, and a profitable contract can be made at once for more than 20 miles of pipe. Address, ED. N. KIRK TALCOTT, Civil and Mechanical Engineer, 57 Broadway, New York. 9-4t

WANTED—A position as shop superintendent of a first class bridge shop. Have had 20 years' experience and thoroughly understand the best methods of getting out all the different classes of work. Am at present superintendent of a shop of 500 tons per month capacity. Good reasons for desiring a change. Can give good references. Address H., care Engineering News. 8-3t

AXEMAN.—Young college man, six months' railroad experience, will take any subordinate place in field or office. Southwest preferred. Reference. Address ANYTHING, Engineering News. 9-3t

TO LEASE—For a term of years a cement property in a new territory, for about one-half its actual value, along a line of railroad. Cement can be made for the minimum cost. To parties interested it will pay to look into this. Address R. O. BEITEL, Nazareth, Pa. 9-2t

WANTED—Steam shovel runners and cranesmen. Souther shovel. Night work. One hundred dollars per month.

CHARLES McFADDEN & SONS,
9-5t North Hector, N. Y.

WANTED—An engineer of 20 years' practical experience on railroads in the North, South and West is open to an engagement. Will accept position as chief of party on preliminary or location, or division engineer on construction, or as engineer in charge for a good contracting firm. Have complete set of field instruments. Best of references can be furnished. Will be glad to confer with parties desiring the services of an engineer. Address T. G. BAYLOR, Charlestown, Jefferson County, West Va. 9-4t

ENGINEERING EMPLOYMENT BUREAU,

ESTABLISHED 1890
Invites Correspondence with Parties Needing

Engineers, Superintendents or Draftsmen.

No Charge Whatever to Employers.
8 GRANGER BLOCK, SYRACUSE, N. Y.

WANTED.—A graduate civil engineer of eight years' experience on first class railroads desires engagement to make location surveys, estimates and specifications, or to take charge of construction; has complete outfit. Address A.B.C., Engineering News. 9-3t

WANTED—Position by first-class draftsman; six years' practical experience on city and railroad work. Best of references. Address "DRAFTSMAN," care Engineering News. 9-3t

WANTED—Pamphlet on "Application of the Principle of Virtual Velocities to the Determination of Stresses and Deflections in Frames," by Prof. G. F. Swain, or the numbers of Journal of Franklin Institute (February, March and April, 1883) in which it was originally printed. CHARLES W. COMSTOCK, 9 East Buffalo St., Ithaca, N. Y. 9-2t

WANTED.—Civil engineer and A1 topographical draftsman, European graduate with 12 years' American experience on railroads, mines, town sites and general surveying in the West and East is open to engagement; has first class instrumental outfit for office and field. Address ACCURATE, care Engineering News. 9-3t

WANTED.—Graduate Civil Engineer, engaged several years at drafting, figuring and designing all kinds iron structures and bridge work, and who has been engaged in contracting all over the country, desires engagement with a reliable firm. If for taking contracts exclusively money only object. Address E. B. P., No. 118 Diamond St., Pittsburg, Pa. 9-6t

WANTED—Position by young graduate engineer, with considerable experience in hydraulic and municipal engineering. Desires to get on structural iron work, but will take anything. Good draftsman, calculator and mechanical worker; understands graphics; experience more desirable than salary. F. G., care Engineering News. 9-3t

WANTED.—A young man with technical education (Yale College) desires position as rodman, draftsman or assistant where he will have opportunity for advancement. Address L. W. W., care of Engineering News. 10-1t.

WANTED.—Assoc. Am. Soc. C. E. would like employment as bridge draftsman. Experience as computer for unusual and peculiar designs and as an author. Address L., care Engineering News. 10-3t.

WANTED—Position in mechanical or topographical drawing room at tracing. Have experience and good reference. Address 146 Neshannock Ave., New Castle, Pa. 10-1t

WANTED.—Roadmaster and graduate engineer, good manager and disciplinarian, thoroughly acquainted with the best practice, wishes to change location. At present with large trunk line. Wishes position as engineer maintenance of way or supervision. Best references. Address R. R., Engineering News. 10-3t

WANTED—Position by civil engineer, age 35, good instrument man, topographer and draftsman, with experience in the design and construction of sewerage, water works, roads, harbor improvements, foundations and heavy masonry. Best references. Address STADIA, care Engineering News. 10-6t

WANTED—By a young graduate engineer, a position as transitman, leveler or draftsman. Have had experience in land surveying and railroad construction and am fair draftsman. Address, "J. K.," care of ENGINEERING NEWS. 10-2t

WANTED—A position as rodman or chainman; am a fair leveler. Best of reference, will go anywhere. I want steady work, not large pay. Address W. H. CHRISTIE, Van Ettenville, N. Y. 10-3t.

WANTED.—A situation as general office man and draftsman in either city or railway engineer's office. Twenty years' experience in civil engineering. References, if required. Box 185, Brooklyn, N. Y. 10-3t.

WANTED.—A bridge engineer, with extended experience in designing and estimating R. R. bridges, and who has also had charge of the drafting room of a large works, desires an engagement. Address A. A., care Engineering News. 10-3t

WANTED.—Young engineer who wishes to combine office and field practice desires position. Will be disengaged April 1. Graduate American technical school; 2½ years' experience. Best of references given. Address "OFFICE AND FIELD," care of Engineering News. 10-3t

WANTED.—Engineer experienced in location and construction and handling large bodies of men, wants position. Will go anywhere. Address A. G. F., Box 266, Hoopeston, Ill. 10-3t

WANTED—Indices to volumes 17, 21, 22, 24; will give 8 cents each for them.

WANTED—Engineering News for Jan. 7, Apr. 15, 1882; Dec. 29, 1883; May 30, 1885; July 13, 20, Nov. 30, 1889; Jan. 11, Mar. 15, Feb. 4, Oct. 31, 1890. Will pay 12 cents a copy. Put name on wrapper when sending papers.

WANTED.—Bridge draftsman and engineer wants a position. Experienced designer of iron bridges and buildings and capable of taking charge of drafting room in a bridge building concern. Address H. S., care Engineering News. 10-4t

WANTED—By a young man, graduate of Mines, Columbia College, New York, position in some branch of the civil engineering profession. Field and office experience. References. Address C. C., care Eng. News. 10-1t

WANTED—A young man, graduate, C. E. School of Mines, Columbia College, New York, would like position as assistant to some suburban engineer. Permanency of more object than salary. Field and office experience. References. Address "WORK," care Eng. News. 10-1t

WANTED—Engagement in an Engineer Corps by a young engineer, graduate of Cooper Institute. Had four months experience as transit and level man in a R. R. location corps. Would prefer construction or tunneling, but will take anything or go anywhere. Address Q. E. D., care ENGINEERING NEWS. 10-3t

WANTED—Position as superintendent of water-works system, thoroughly competent to take full charge, and is familiar with all kinds of work connected with water-works plant. Has eight (8) years experience. Satisfaction guaranteed. Can give undoubted reference. Address R. J., care Engineering News. 9-2t

WANTED—Bridge engineer, with 11 years experience, wants position. Perfectly familiar with making shop drawings, as well as estimates on all kinds of bridge and roof work. Address BRIDGE, care Engineering News. 11-3t

WANTED.—A graduate civil engineer of 10 years' experience on railway and government work desires engagement; is especially experienced as a locating engineer in a mountainous country and in heavy railroad construction. Address C. D., Engineering News. 9-3t

WANTED—Position by civil engineer as transitman, rodman or tapeman on railroad or city work, or as assistant in any surveying or engineering work. College education; age, 23. Address H. I. S., Box 160, Frankfort, Ross Co., O. 7-6t

WANTED—Position as engineer on sewer work. Have first-class transit and level. Address X X, care Engineering News. 9-3t

WANTED.—A second-hand transit of some standard make in good condition. Am willing to pay a reasonable price. Plain transit or with only arc and tel. bubbles preferred. Address E. H. LEE, Joliet, Ill. 11-1t

WANTED—To hire a Transit with level attached (Buff & Berger or Heller & Brightly make) for three months, with intention of purchasing if found satisfactory. Address TRANSIT, care of ENGINEERING NEWS. 11-1t

WANTED—Position by a competent and energetic young man with three years' experience in city and railway engineering. First class with instruments and a good draftsman. Small salary. A1 reference. Address J. K. A., care of ENGINEERING NEWS. 11-3t

WANTED—Position on construction. Hydraulic work preferred; am competent to take charge of work. Good experience and first class references. A permanent position will be an object as well as salary. E. N. P., care Engineering News. 11-3t

WANTED—Situation by an engineer, aged 33. Railroad work preferred. Have instrumental outfit for both office and field. Neat and rapid draftsman. J. F. HUNT, 67 Sigourney St., Hartford, Conn. 11-3t

WANTED—A field assistant by engineer and surveyor. Pay $75 per month and expenses away from headquarters. Only a hustler of experience who can do accurate subdividing and surveying rapidly is wanted. Preference to one in vicinity of Chicago. Address H. W. T., 511 Royal Insurance Building, Chicago, Ill. 11-1t

WANTED.—Young man, 27 years of age, six years' experience, at present employed on M. W. P. R. R., would like to change. Am well acquainted with transit, level and track work. Address M. W., care Engineering News. 11-3t

WANTED—A position as rodman, levelman or transitman by a young graduate in civil engineering. Will go anywhere in North or South America. Either temporarary or permanent employment desired. H. P. SIMPSON, Tuskegee, Ala. 11-3t

FOR SALE.—An old established engineering and surveying business on north side of Long Island. Place growing; splendid opportunity for young man. Complete outfit, including large amount of valuable data and maps. Address B. D., Engineering News. 10-2t

LABOR.

JOSEPH BRUNO, *Contractor.*

Italian laborers supplied and work superintended. Address 15 London St., East Boston, Mass.

DONATO CUOZZO, *Contractor.*

Italian laborers supplied and work superintended. P. O. Box 420, Stapleton, N. Y. New York Office, 60 Spring St.

CHARLES P. MARTINO.

Italian laborers supplied for railroads, waterworks, etc. Address 242 N. 5th St., Brooklyn, E. D., N. Y.

To Surveyors.

An established surveying business and office for sale, within 10 miles of New York City. An excellent field for an energetic young man. Good reasons given for selling. Address SURVEYOR, Engineering News. 8-4t

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